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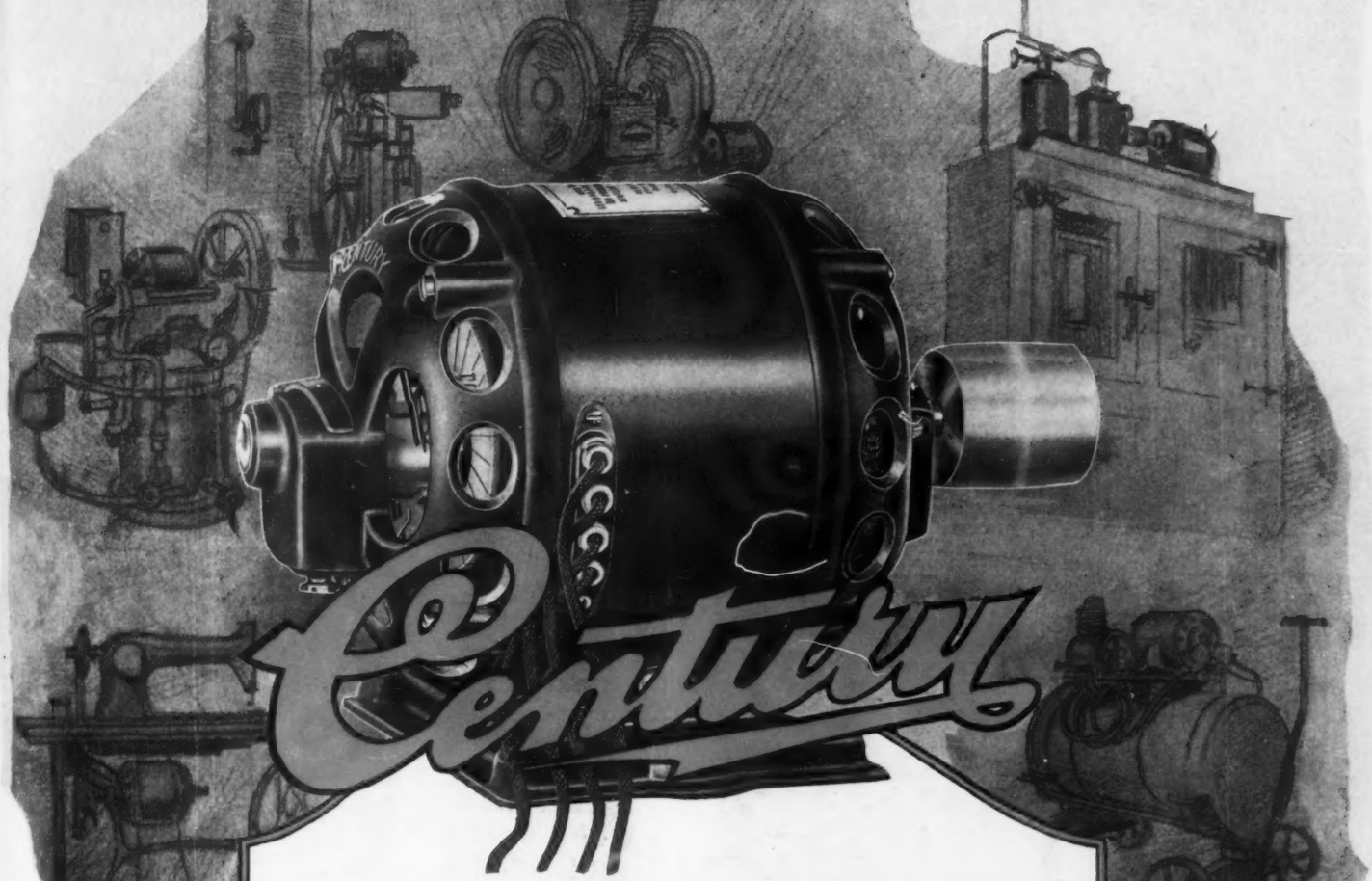

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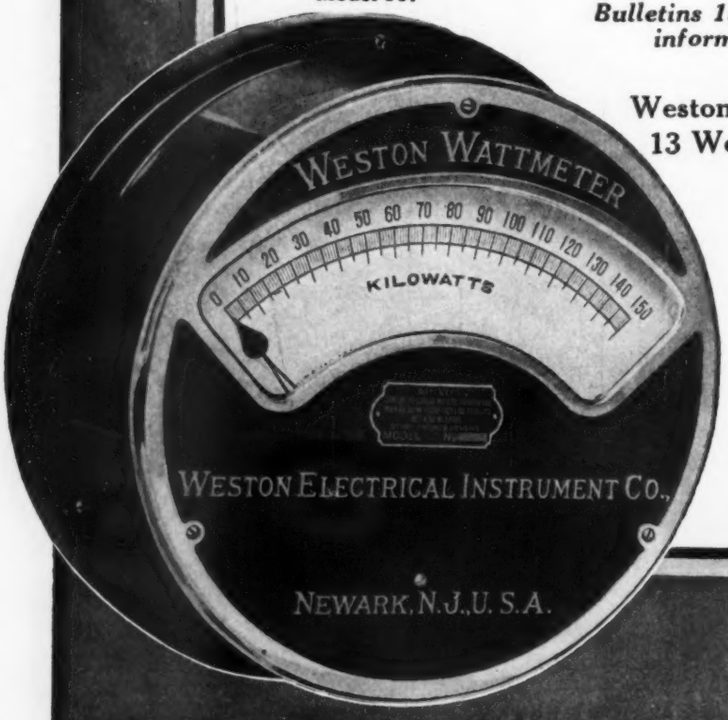
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Electrical World

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Thrift Campaigns and Self-Interest

ELECTRICAL men naturally like to think of Franklin as a great electrician and to link him indissolubly with their industry. But while Franklin was a scientist, he was more; and it is particularly to another accomplishment of his that men everywhere are referring this week. "Save, young man, and become respectable; it is the quickest and surest way," epitomizes Franklin's philosophy. Of thrift he was the great exponent, and by thrift is not meant hoarding but wise expenditure; for thrift connotes neither niggardliness nor miserliness. Thrift means success and advance in the acquisition of property, increase of worldly goods, prosperity. Surely none can gainsay the wisdom of preaching thrift at this or any other time, individually and nationally, and allying it with self-interest. Self-interest prompts the practice of thrift and the investment of the savings. Particularly attractive for this purpose are the bonds and stocks of strong electric light and power companies whose properties are managed by men of technical skill and broad business experience and whose securities are issued under the supervision of public service commissions. If those connected with the electrical industry will put their savings in it and induce others to do likewise, the electric light and power companies of the country will thereby be enabled to prosper and progress and to expand commensurately with the growth of the communities they serve. Thus the community gains, the industry gains, the individual investor gains, and all those connected with or serving the electrical industry profit accordingly. This is thrift in its highest sense.

Enlarged Activities of the N. E. L. A.

WE HAVE watched with considerable interest and admiration the new spirit animating the National Electric Light Association and the widening influence of that great body in industrial and civic affairs. This development has not escaped the attention of the other branches of the industry, and they not only recognize the value of the work being done and its purport, but are anxious and willing to co-operate in the program to the end that the campaign of good will which has begun so auspiciously shall be carried through successfully and triumphantly. Seldom have the individual electric light and power companies taken such an active interest in association affairs, and never has the association meant so much to them. During the coal crisis the association was not found wanting, and in dealing with the National Association of Railway and Utility Commissioners, the Investment Bankers' Association, the Federal Power Commission, the United States Chamber of Commerce and other vital organizations the part played by the National Electric Light Association has been helpful and effective. Co-operation with the other national associations in the electrical industry has also been wholesome and generous. Coming on top of the reorganization of the association, these activities have meant enormous work on the part of the staff at headquarters, but under the guidance and inspiration of so energetic and enthusiastic a worker as Executive Manager M. H. Aylesworth the added burdens have been borne with pleasure. On him more than any one else the greater part of the work has fallen, and to his vision and foresight much of the success which has already been accomplished is due. A great deal is expected of the good-will campaign now under way, and with the hearty co-operation of manufacturers and of other branches of the industry, as well as every individual in the utility field, the outcome is sure to exceed expectations.

Self-Interest of Industrial Plants in Utility Financing

DURING the past few years of high prices, long deliveries and comparatively low electric rates central-station service has helped power customers make the large profits which have diverted capital from utility companies to industrial channels. Central stations have been unable to make proper betterments or adequate additions to their plants during this period, and although the majority of power customers have accepted curtailments of electric service very philosophically, nevertheless they are prone to forget that electric rates do not even cover interest charges in all cases and never provide for needed improvements and a surplus. Even some large customers have failed entirely to understand why central stations are unable to supply all power requirements all of the time. Consequently plans are being made by these customers to build new isolated plants or rehabilitate old ones when equipment prices have dropped to what may be considered a new normal level. The time is opportune, therefore, to convince all large customers that there is a real partnership basis on which they can obtain adequate central-station service. The money invested by the utilities during pre-war times created the generating and distributing systems which enabled the industries to produce large quantities of very profitable merchandise. Now that utilities want money to rehabilitate their properties and to build up their reserve capacities to a pre-war basis, the logical investors in their securities are the customers who have profited most by the service and have a local self-interest in the utility as an institution contributing an essential service to the progress of the community. When this truth comes to be fully grasped by the industries dependent on electrical energy for their prosperity an era of co-operation should begin that will solve many financial problems.

Electric Trucks, Like Other Vehicles, Need Care

THE electric road truck has suffered in the past from the notion that no skill or knowledge of its nature and needs is required on the part of the operator. Statements to this effect from supposedly authoritative sources have appeared from time to time. It is, therefore, encouraging to note that recognition of the fact that the truck is a mechanical and electrical device that needs as intelligent care as any other similar device is on the increase, and that manufacturers and central stations interested are taking decided steps to educate owners and operators in the proper care and operation of their vehicles. The recognition of electric vehicle operation among the mechanical branches taught in the public schools of Chicago is another hopeful sign. The electric road truck can no more perform its task successfully without intelligent handling than can the gas-engine vehicle.

Foundation for Rural Rates Should Be Built

A FORM of rural rate that will include all items of cost of service is an important contribution to the rural service discussion. The article by Prof. J. O. Kammerman elsewhere in this issue is important because it reaches further toward the fundamentals than most of the discussions that have so far appeared. There will undoubtedly be much disagreement in many quarters with the numerical values assigned to the various factors in this article, but it should be remembered that these numerical values represent variables to which a large amount of study must be given before it will be possible to assign values confidently for even a single locality, much less for an entire section or the whole country. The important feature around which discussion should center is the principles underlying the problem. If their soundness can be thoroughly established, the assigning of correct values for any situation becomes largely a matter of detail study of the special case with rather limited chances of serious error. If the underlying principles of the scheme are wrong, no amount of concentration on detail study will produce anything except serious trouble. The whole purpose of the article is to formulate a method that will consider all factors of cost and produce a return to cover the fixed and variable charges. When this method has been established, the exact numerical values assigned to each factor and the profit on the business will be a relatively simple study. A further fact to which the article clearly points is that uniform rates to cover all extensions even in the territory of a single utility cannot be worked out because of the variation in number of customers per mile and the variable cost of lines and equipment per customer.

No Place for Vindictiveness in Industry

EVER since the complications of modern civilization began labor and capital have been engaged in a give-and-take combat of mutual exploitation. Labor has generally been the weaker, and its gains over any stated period have been gradual and small. Two years ago it came into what its leaders and champions no doubt honestly deemed "its own." Everybody knows the result. Capital, driven to the wall, paid wages that steadily grew to previously undreamt-of proportions for an output that steadily diminished; commodity prices soared higher and higher; the merry profiteer profiteered, and in the end labor gained far less than it had thought to do. Now the fortunes of battle have changed, the tide of non-employment is rising, and anxiety once more has taken possession of the wage earners. Human nature suggests to industrial employers that their inning has come round again and that the chance is here to avenge the hold-ups of the last two years and put labor in its place once more. Such an idea was bound to arise. None the less, if the indissoluble partnership of capital and labor is ever to be anything but a mutually destructive duel, a more mistaken policy could not be conceived. Vindictiveness is a two-edged sword. It has no place in the industrial world. It would play directly into the hands of communism and propagate belief in "direct action" of the Russian brand. Rather is this a time to rise above the primitive impulses—a time for breadth of view, for liberality of judgment, for generosity of terms. It is a time to rebuild, and to build for the future, along the lines of organized co-operation, of profit sharing, of employee representation or of individual rewards, as may be best in each particular case. In the long run it will prove as much to the benefit of capital as of labor if when these chaotic years shall at last be over and mankind shall settle down to industrious routine once more there shall prove to have been not a temporary and deceptive but a permanent and absolute advance in the earnings of every useful trade honestly followed.

Effective Interconnection Requires Team Play

IN THESE days of team play among public utilities the subject of interconnection rises to large importance, not only here and there and casually, but as a policy to be followed whenever feasible. The little discussion by A. T. Throop elsewhere in this number of some practical phases of interconnection from the psychological rather than the physical standpoint will prove instructive reading. Granted that a group of adjacent utilities want to take advantage of the large possibilities of interconnection, the terms and arrangements of such interconnection are easy enough to work out in general, but the details sometimes involve complication. Broadly speaking, there are two classes of interconnection—full pooling of resources for the benefit of the systems as a whole and exchange of power on some equitable basis as between one system and another. Exchange of power involves no special trouble except settling the price, for it is easy to draw a suitable contract and make proper arrangements for metering. If the proposed arrangement provides benefits for both parties, as it generally does, the matter almost settles itself. It is in plans for full interconnection that working difficulties are more often found.

Mr. Throop lays stress on the absolute necessity of a frank and open spirit of fair play between all the companies concerned. If interconnection is skillfully carried out, it can be of large commercial benefit to everybody concerned, but to win out to this successful result means fairly and squarely playing with the cards upon the table, with a frank spirit of give and take, willingness to make concessions and a spirit of genuine and whole-souled co-operation. It is the necessity of such a close working agreement that often proves the chief

motive for an actual merger, a motive far stronger than any furnished by a common purchasing system or a unified scheme of financing. It is the unified spirit of co-operation and management day by day and hour by hour that makes for genuine success in interconnection.

Reducing Labor Costs Electrically

EQUIPMENT that offers a quick return on the initial investment through the reduction of labor costs is becoming increasingly attractive to industries of many kinds. A brief article by J. S. Tuthill gives some extremely useful information regarding the extent to which electrical methods have supplanted human labor in the mere matter of handling and conveying material. Our old friend the industrial electric truck is steadily at work replacing the hand truck, and a little detailed investigation in one factory showed that a single truck is doing more work in an eight-hour shift than twenty-five men. In another shop four trucks and one tractor displaced twenty-five men with hand trucks, eight horses and their drivers and the services of a switch engine for two hours per day. And so the story goes on. Where the truck does not come into play the conveyor gets busy, and in one instance cited by Mr. Tuthill an overhead trolley conveyor system paid for itself in less than six months. Where the conveyor is not conveniently applicable the electric crane with an electromagnet can usefully take a hand in the game, loading a 50-ton car in half an hour. One or two men with adequate conveying machinery can displace a score working by old-fashioned methods, thereby releasing just so much available labor for those tasks to which electrical equipment has not yet been adapted.

Water Supply for Steam-Plant Purposes Needs Study

WATER as a vital factor in the operation of a large modern steam plant is too little appreciated. Intensive studies of available supplies for hydro-electric use have been made in a few cases, but as a whole insufficient attention has been devoted to the matter from the viewpoint of the large steam plant of the future. A very important note was struck in the recent water congress called in Kansas by Governor Allen to consider new water-resource laws when the discussion developed the fact that, though there are some hydro-electric power possibilities in the state that should not be overlooked, the industrial development of Kansas—already, it is said, overshadowing the agricultural development in value of products—is dependent on the future supply of power from steam plants. As a result, the subject of water supply for such plants will have a place in the work of the proposed water commission, along with irrigation, domestic water supply and food control.

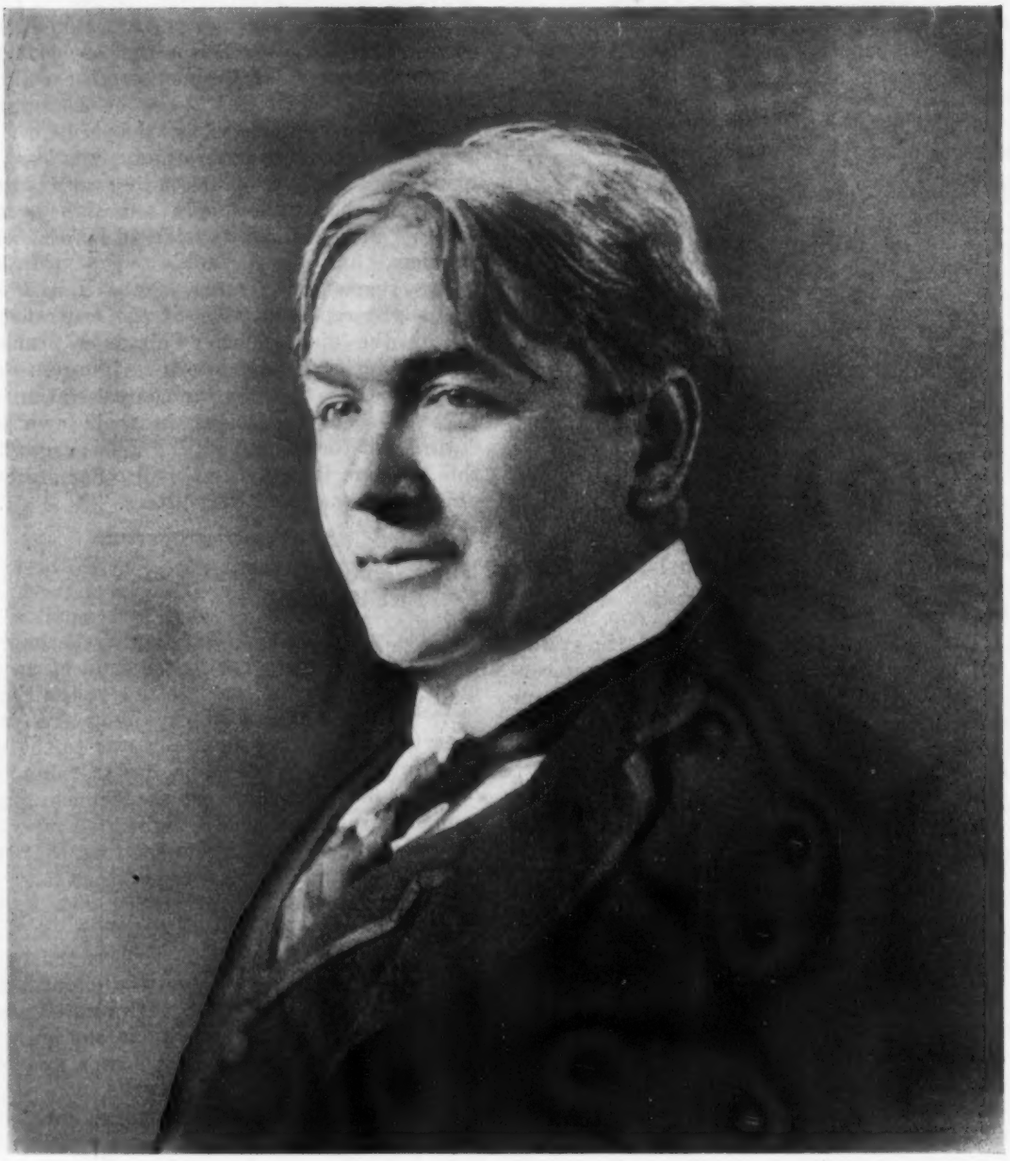
The discussion at Topeka, in the water congress and also in a meeting of the Kansas Engineering Society, brought out the fact that the problem is more than a Kansas affair. Studies of the past three or four years in the Eastern States have indicated that there are relatively few sites away from tidewater or the great lakes at which unlimited water supplies are available. When convenience of transportation, proximity to fuel supplies and locations convenient to the power market are added to the problem, the available sites narrow down to an extent that startles even the men who have the most intimate knowledge of the situation. Prior claims on water because of long use and riparian rights add more complications. With this situation developing in the sections where rainfall and therefore water supply are presumed to be ample, it can be easily seen that the industrial developments in the Middle Western and Western States, where water supply is less plentiful, will bring increasingly embarrassing problems unless the study of the water-supply situation over the entire country also includes consideration of the steam-plant problem.

One regrettable feature of the Kansas meeting was the slight representation of the central-station industry in the discussions. This is a problem that the central station cannot afford to ignore. Fortunately it is not too late for Kansas central-station men to take part in such discussions in their own state in the future and for central-station men everywhere to bring this problem into discussion in other states and before appropriate national committees.

Dirty Lamps as a Source of Fire Hazards

IT IS, of course, a familiar fact that inflammable material in contact with the bulb of an incandescent lamp may reach the temperature of ignition. The bulb temperature itself, with the lamp free and clear of everything, does not generally rise to the danger point even in case of large lamps, but the shutting in of the outward flow of heat from the filament may carry the temperature dangerously high in a very short time. This fact is so commonly understood that the incandescent lamp, far less dangerous than any other usual illuminant, involves no real fire risk under ordinary circumstances. Cases arise, however, when inflammable material in the form of dust coats the lamp bulb and can be brought to the ignition point. It also may happen that a lamp bulb breaks and exposes gas-laden or dust-laden air momentarily to the high temperature of the filament. Very little has been known concerning the actual magnitude of risks thus incurred, and we are extremely glad to present a paper elsewhere in this issue by Messrs. Dows, Fox and Blackwell giving an experimental study along this line.

The practical moral to be drawn from these data is that wherever organic dust is likely to be widespread, as it is in flour mills and similar situations, the same precautions should be taken with installing and maintaining incandescent lamps that would be required in the presence of any highly inflammable or explosive material. The bulb itself should in such cases be inclosed in an outer globe somewhat as it is in marine practice, a globe practically dust-tight and big enough to present a radiating surface sufficient to keep down the possible temperature even should the surface become coated with dust. Ordinary common sense in the cleaning of fixtures of this type would free them from dust inside and out and remove any possible source of danger either from direct heating or from the breaking of the bulb. The same precautions should be taken with dust-laden air of the kind here considered that one would take with gases and vapors known to be explosive. There is occasion not for blaming the incandescent lamp, but rather for putting dusty air in the class of unusual hazards where it belongs.



Arthur Williams

Champion of progressive thought and public policy pioneer who has been unusually successful in his efforts to develop the human side of industry

OF ALL the classes of utilities none holds a higher or more secure place in the public esteem than those engaged in supplying electric light and power service. Nor is this a matter of chance or luck; it is, rather, the result of honest effort to give the best possible service. That this work has been done well is largely so because of the early guidance of a small number of clear-thinking electric light and power executives, among whom was Arthur Williams, now general commercial manager of the New York Edison Company. Mr. Williams was one of the first to have the broader vision of public policy. When the National Electric Light Association fifteen years ago, under William H. Blood's administration, first decided to appoint a public policy committee Mr. Williams, who has always championed progressive thought, was chosen to head it.

Although an engineer, his efforts have been directed largely to the development of the human side of industry in contrast with the mechanical. In the solution of personnel problems he is a pioneer whose fame has traveled so far outside his own industry that he was chosen first president of the National Association of Corporation Schools. Good employee relationship engendered by directed education, pensions, annuities, savings and loan funds, social activit'es and a mutually friendly spirit are the lines along which he has worked and which have brought his success. While Mr. Williams is essentially a practical psychologist, he never could have accomplished his purpose in this direction had it not been for his sympathetic understanding of and love for his fellows.

Mr. Williams was born in Norfolk, Va., Aug. 14, 1868, and when sixteen years old entered the electrical industry with a firm of electrical contractors in New York City. A few weeks later he was employed in the old Pearl Street Edison station. By hard work and close application he advanced through the electrical engineering side of the industry, and when a public contact man who was an engineer was needed he was appointed to the position of general inspector in 1890 and three years later became general agent in addition. Ever since that time Mr. Williams has directed the commercial growth of the New York Edison Company.

It would be hard to find another man in the electrical industry, or in any other industry for that matter, who has been engaged in so many activities outside his own company. It was in his office that the old Electric Vehicle Association, of which he later was president, was formed. He has been prominently identified with safety work as president of the Safety Institute of America. He is a past-president of the N. E. L. A. and the Association of Edison Illuminating Companies and many others of more local interest. During the war he was Federal Food Administrator for New York City.

Rural Service Rates Must Cover All Costs

Factors Entering Into the Cost of Service—Differences from Urban Business —Transformer Losses Have Run as High as 75 per Cent of Consumption— Cost-Plus-Profit Rate System Applied—Comparison with Isolated Plant

By J. O. KAMMERMAN
Professor of Electrical Engineering South Dakota State School of Mines, Rapid City, S. D.

THE rural dwellers of this country have long realized the advantages enjoyed by the people in cities who are supplied with electric light and power, but not until recent years has serious attention been paid to the possibility of supplying electric service to rural customers. During the last three or four years farmers in all parts of the country have enjoyed unprecedented prosperity, and with this has come an active demand for the modern conveniences enjoyed by the residents of cities. One of the foremost demands is for electric light and power on the farm. As a result the following two methods of supplying power to the farmer have been developed along commercial lines:

1. By means of small transformer substations located along existing high-tension transmission lines.

2. By means of isolated generating stations, usually consisting of a small direct-current generator, a gas, kerosene or gasoline engine and a storage battery.

From the discussion which is to follow it will be evident that the second method is usually not worth consideration where there is a transmission line in the vicinity to be served. Where power is available from a central station, there are two distinct methods of financing the project:

1. The central station contracts to furnish power to the rural consumer in much the same way as in cities.

2. Groups of farmers organize to purchase power at wholesale rates from the central station and to resell it among themselves.

It is not the purpose of this paper to advise the adoption of either of these plans. Local conditions of service and public sentiment must be considered in every installation. A digest of the cost of service, or rather an adequate rate for service, will be discussed. Several state organizations which have control of public utilities have made a study of rates for electric service to rural communities. These investigations have led to various conclusions, and from an analysis of these a method of determining a rate will be arrived at.

NATURE OF RURAL SERVICE

Many central stations that have undertaken to supply power to rural residents have made a financial failure of their extensions owing principally to failure to consider duly the different diversity factors met in rural work. Some stations have lost rural customers by making an excessive charge for their service and power. There is an inherent difference between the rural and the urban customers, and due account of this must be taken before rural extensions can be put on a paying basis. In cities power and light customers may average four or five to the block, while in the country they may average four or less to the mile. This difference is the chief difficulty that has been encountered in making rural extensions a sound financial project.

The watt-hour meter on a rural line is supposed to register all the power delivered to the line, which includes the transformer core losses, but, as the power factor of the line is very low (below 50 per cent), there is some doubt as to whether or not the meter records the losses. A conception of what this loss to the power company means can be gained from a study of Table I.

TABLE I—CORE LOSSES OF STANDARD DISTRIBUTION TRANSFORMERS

Transformer Size, Kva.	Loss in Kilowatt-hours per Year					
	2,300	115 volts 230 volts	6,900	115 volts 230 volts	13,800	115 volts 230 volts
1.0		166		....		....
1.5		....		236		....
2.0		210		....		....
2.5		....		....		403
3.0		280		315		....
5.0		350		438		596
7.5		473		604		....
10.0		560		762		928
15.0		770		1,000		1,400
15.0		1,150		1,500		2,100

This table was compiled from a table of core losses on a list of standard commercial distributing transformers built by one of the leading electrical manufacturers in this country. When a utility is selling power to an organized group of farmers and the master meter fails to record the core losses, some other method of charging for them must be used. From some actual observations made, the annual transformer core losses of a rural extension have been found to be as much as 75 per cent of the total power consumption.

SERVICE COST FACTORS

In order to obtain some basis for comparing the various methods of distributing the power costs among the rural customers, a list of factors has been compiled in which an attempt is made to determine a return to the utility from the rural extension that will just compensate for the fixed and variable charges, as follows:

1. Six per cent of total construction costs to cover interest on the investment.

2. Two per cent of total construction costs to pay for the "risk" of constructing the line.

3. One and one-half per cent of total construction costs to pay the taxes.

4. Five per cent of total construction costs for maintenance.

5. Four per cent of total construction costs to cover depreciation of the extension.

6. A charge for the total transformer core losses for the year at the utility's switchboard rate.

7. A charge for the total power consumed for the year at the utility's switchboard rate.

Item No. 1 in this list is the usual charge made in fixing a selling price of any commodity, but should the extension be owned by the customers this item must be omitted by the utility in fixing the rate. Item No. 2 is now recognized by most rate-controlling bodies as

an allowable and just charge which is intended to reimburse the utility for the hazard encountered in constructing the line. When one considers that a customer may or may not connect to the line, or that he may connect for a time and then discontinue the use of this service, this charge is not unreasonable. It is as justifiable as a premium on a fire insurance policy.

Item No. 3 will vary according to the location. One and one-half per cent is given here as an average covering a number of cases in various states. In no instance was a wide departure from this average found.

In item No. 4, 5 per cent is obtained by taking the usual 2½ per cent maintenance and operating charge on city lines and adding 2½ per cent for the increased cost of reading meters and making repairs on rural lines.

The depreciation of a line depends upon the quality of material put into the line and the workmanship. A rate of 4 per cent was taken in item No. 5 for depreciation because usually a life of about sixteen years is assumed for rural extensions.

In items Nos. 6 and 7 the core losses and power costs are charged at the utility's switchboard rate because this rate is assumed to be ample to cover the operating expenses within the power house.

This gives a method for handling the rural extension business. When the utility owns the line, transformers and meters the customers are charged a fixed sum of 18½ per cent of the cost of construction, plus the energy charge for core loss and power delivered to the consumer, plus a reasonable profit. This might be termed a "cost-plus-profit" system.

In the use of this system the following advantages and disadvantages are encountered:

1. The rural customer is assured an adequate supply of power at all times.
2. Utilities are now forced to pay a high rate of interest on money borrowed for extension purposes.
3. If those connected to the line cease to use the service, the power company is at a large loss.
4. An adequate return for energy delivered is assured the utility.
5. The monthly bills to the customers will be large.

Looking at the proposition from the consumer's standpoint the first of these paragraphs indicates what is most desired. From the utilities standpoint, the adequate return mentioned in the fourth paragraph is most desired. The other paragraphs concern disadvantages, but not insurmountable obstacles. No system can be devised which will satisfy in all respects the wants of the utility and of every consumer. The vital points tending to create harmony between the buyer and seller are those numbered 1 and 4. These advantages are gained by using the "cost-plus-profit" system. Local conditions will best determine how to overcome the disadvantages; many methods might be advocated here, but that is not the scope of this paper. The system is simple and can be understood by both the utility operators and the consumer.

APPLICATION OF METHOD

Table II gives data on eleven extensions which have been operating for periods of more than a year. It is an example of the application of the "cost-plus-profit" system. The column of "per cent return on investment" shows clearly that a uniform rate cannot be made to rural customers. The column of "cost per kilowatt-hour" shows a wide variation caused by the number of customers per mile and the amount of power consumed annually. Some objection might be raised to the high rate in most of the cases. However, if the rate is compared with that arising from the use of an isolated-plant system, the plan of financing the extension and of fixing the rate which is advocated will be found to stand the comparison well.

The cost of extensions, where figured per mile, will vary to some extent. The "cost of extensions" as used in this article includes poles, wire, insulators, transformers, cross-arms and accessories necessary for proper installation, meters, labor and engineering. It does not include the cost of the service wire from transmission line to house or any labor for the installation of the service wire. The voltage used on the extension will depend in part on the length of the line and the amount of power delivered. The cost of a 2,200-volt line per mile should not be compared with the cost per mile of a 13,200-volt line. Since rural extensions will vary anywhere from a mile to 10 miles or more, it seems rather impossible to arrive at a figure which might represent the cost of construction per mile and could also be used for estimating any new extension, unless the proposed extension was to be similar to the extension already operating. In that case the cost of the new extension could be estimated from the known cost of the operating extension with a fair degree of accuracy.

It is evident that the number of customers per mile will affect the cost of an extension when the transformers are considered a part of the extension.

ISOLATED-PLANT COSTS

In order to determine the cost of power when furnished by rural farm-lighting sets, the data on a 1.5-kw. plant appearing on the next page was secured from several manufacturers to arrive at cost of battery, cost of gasoline engine and generator (complete with necessary switches and meters) and fuel and oil consumption of engine. An average was struck from the several replies, and this was used to determine the cost of power. In calculating the fixed charges, 6 per cent was taken for

TABLE II—DATA ON ELEVEN RURAL EXTENSION TRANSMISSION LINES THAT HAVE BEEN OPERATED FOR MORE THAN A YEAR*

Case No.	Cost of Extension	No. of Customers	Kw.-hr. Purchased per Year	Length of Lines (Miles)	Transformer Core Loss per Year, Kw.-hr.	Utility Switchboard Rate†	Fixed Charges 18½ per Cent	Cost of Core Loss	Power Cost	Total Annual Income	Per Cent of Return on Investment	Cost per Kw.-hr. (No Profit Added)
1	$1,858	9	3,782	2.0	1,566	$0.027	$344	$23.50	$56.70	$424.20	22.8	$0.112
2	920	8	1,671	1.0	1,230	0.06	170	73.70	100.00	343.70	37.3	0.205
3	665	5	1,197	1.1	1,050	0.06	123	63.00	71.80	257.80	38.8	0.215
4	500	2	1,279	0.9	700	0.06	92	42.00	76.70	211.20	42.2	0.165
5	11,414	39	7,420	12.0	2,481	0.008	2,115	19.80	59.40	2,194.20	19.3	0.209
6	1,550	7	1,650	1.5	656	0.008	287	5.24	13.20	305.44	19.7	0.185
7	2,246	8	1,720	2.0	1,260	0.008	416	10.10	13.80	439.90	19.6	0.255
8	1,450	17	4,439	3.0	1,105	0.008	268	8.80	35.50	312.23	21.5	0.070
9	1,265	9	2,520	1.2	1,616	0.008	234	12.90	20.20	267.10	12.1	0.106
10	1,562	6	1,769	2.0	1,400	0.03	289	42.00	53.07	384.87	24.6	0.217

* In this table the cost of extension represents the cost to the utility only. Customers' investment in service lines is not included, nor has any use of existing pole lines to carry new circuits been compensated for. The cost figures cannot therefore be used as measures to determine the cost of lines and equipment in other cases. These must be worked out in each individual case. Rates per kilowatt-hour represent utility cost only. Profit must be added.

† By utility's switchboard rate is meant the cost of power delivered to the switchboard.

Cost of battery	$155.00
Cost of engine and generator	445.00
Total cost	$600.00
Interest on investment	$36.00
Depreciation on battery	38.75
Depreciation on engine and generator	44.50
Fixed annual charge per year	$119.25
Fuel and oil cost per kilowatt-hour	0.0625
Assuming 500 kw.-hr. are used per year:	
Fixed annual charge per year	$119.25
Fuel cost (500 kw.-hr.)	31.25
	$150.50
Cost per kilowatt-hour	0.301

If only 300 kw.-hr. was used per year, the cost per kilowatt-hour would rise to $0.46.

interest on investment, the life of the battery was assumed to be four years, and the life of the engine and generator was assumed to be ten years. The price of fuel was taken at 27.8 cents per gallon. The average results were as shown in the accompanying table.

As the isolated plant in most instances is in the hands of one not experienced, the cost of repairs or maintenance has been omitted, because this could vary from a few dollars per year to the cost of the plant.

No one system could be devised that would work equally well in all parts of this country as rates of interest and types of construction, which will necessarily cause the maintenance charges to vary, are different in different localities. These factors do not vary so erratically that they cannot be fixed within the boundaries of any one state, and it would be an easy matter for any state rate-regulating body to fix fair percentages for all of the items mentioned under the "cost-plus-profit" system.

Lighting for Dusty Places

Lamps in Grain Elevators and Similar Places Should Be Protected Against Breakage and Heavy Dust Accumulation—Good Safety Factor Possible If Lamps Are Properly Applied

By CHESTER L. DOWS,* E. B. FOX,† W. P. BLACKWELL‡

BECAUSE its bulb temperature is higher than that of the vacuum lamp, the gas-filled lamp has always been looked upon with more or less suspicion as a fire hazard from the time it first made its appearance in the latter part of 1913. Recently research has been undertaken to determine the hazard when lamps are used in the dust-laden atmosphere common to grain elevators, flour mills and the like, where disastrous explosions take place so frequently as to form a serious menace.

The results of these tests show that all the vacuum lamps up to and including 100 watts, and possibly the lower-wattage gas-filled lamps, may be used with safety in certain establishments where the dust has a high ignition temperature so far as danger from fire caused by dust collection on the bulb is concerned. However, no lamp should be allowed to become thickly coated with dust, first because of the danger of fire, and second because of the great loss in illuminating value. In some cases lamps actually become buried in the grain, and the hazard under such conditions is extremely great.

FIRES ATTRIBUTED TO TWO CAUSES

It must always be remembered that a fire may be started with any incandescent electric lamp, vacuum or gas-filled, or, for that matter, with any device that could be used for illumination, if it is operated continuously when so surrounded that the heat must accumulate. Under these conditions—the continuous accumulation of heat energy—the temperature of the surrounding material will steadily rise until it reaches a temperature at which the energy is dissipated as rapidly as it is supplied, and if this final limiting temperature is sufficiently high, a fire may be expected as a natural result if combustible materials are present.

The possibility of fires or explosions from incandescent lamps in dusty atmospheres, such as are usually found in the handling of grain, starch, flour, oatmeal, chocolate, sugar, etc., may be classified under two heads: (1) Fires directly caused by ignition of dust collecting on lamp bulbs; (2) explosions caused by accidental breakage of incandescent lamps in an atmosphere which has the proper proportions of dust and air to make it explosive.

Practically all of the carbonaceous dusts found in the milling and allied industries will smoke and give off an odor if they are allowed to collect on the bulb of a gas-filled lamp. This was at first considered as indicative of danger because smoke was generally interpreted as representing a fire. Experiment shows, however, that there is a substantial margin between the smoking and ignition temperature. This margin may be safe or unsafe, depending on the ignition temperature and character of the dusts and the temperature of the heated body on which the dust collects. It is very much less in some cases than in others.

It will be observed that with only two exceptions the margin between smoking and ignition temperature increases with increase of ignition temperature. That is, the smoking temperature, while varying slightly, is roughly of the same magnitude for all dusts tested. The extreme limits are found to be 284 deg. Fahr. (140 deg. C.) and 331 deg. Fahr. (166 deg. C.), without much regard to the type of dust and ignition temperatures. These smoking temperatures are about the same as the operating temperatures of the lower-wattage gas-filled lamp bulbs (75 watts and 100 watts), but are 100 to 150 Fahr. deg. (56 to 83 C. deg.) higher than the bulb temperatures[1] of vacuum lamps of corresponding wattage. This accounts for the fact that dusts smoke readily on gas-filled lamps and do not on vacuum lamps.[2]

The ignition temperatures of the first four unusually

*National Lamp Works, General Electric Company.
†Edison Lamp Works, General Electric Company.
‡Westinghouse Lamp Company.

[1]Differences in temperature are expressed as Fahr. deg. and C. deg.

[2]The bulb temperatures of vacuum lamps larger than 100 watts approach more nearly those of the lower-wattage gas-filled lamps.

chaffy dusts and cocoa, it will be noted, are all above 500 deg. Fahr. (260 deg. C.), and there is a margin of from 182 to 245 Fahr. deg. (101 to 136 C. deg.) between their smoking and ignition temperatures. The remaining four dust samples will not ignite until temperatures of 883 deg. to 934 deg. Fahr. (473 deg. to 501 deg. C.) are reached, making the margin between smoking and ignition around 574 to 623 Fahr. deg. (319 to 346 C. deg.) for these samples. Extra chaffy dusts, therefore, collecting on vacuum bulbs must be raised over 300 Fahr. deg. (167 C. deg.) before taking fire; on the 75-watt and 100-watt gas-filled lamps over 250 Fahr. deg. (139 C. deg.), and on higher-wattage gas-filled lamps over 150 Fahr. deg. (83 C. deg.). In an especially constructed chamber in which a continuous dust cloud could be maintained it has been possible to start a fire on the larger gas-filled lamps with each of the first four samples listed above. No fires were obtained with 75-watt and 100-watt gas-filled lamps and none with vacuum lamps up to and including 100 watts.

TABLE I—MARGIN OF TEMPERATURE BETWEEN THE SMOKING AND IGNITION POINT OF DUSTS

Name of Dust	Smoking Temperature, Deg. F.	Smoking Temperature, Deg. C.	Melting * Temperature, Deg. F.	Melting * Temperature, Deg. C.	Ignition Temperature, Deg. F.	Ignition Temperature, Deg. C.	Difference Between Smoking and Ignition Temperatures, F. Deg.	Difference Between Smoking and Ignition Temperatures, C. Deg.
Sample No. 2	288	142	...	...	511	266	223	124
Sample No. 1	331	166	...	...	513	267	182	101
Sample No. 4	295	146	...	...	532	278	237	132
Sample No. 3	298	148	...	...	536	280	238	132
Cocoa	313	156	...	...	558	292	245	136
Graham flour	309	154	552	289	883	473	574	319
Cornstarch	284	140	545	285	891	477	607	337
White-wheat flour	315	157	507	264	919	493	604	335
Cornmeal	311	155	527	275	934	501	623	346

No. 1, durum wheat dust. No. 2, approximate percentage: oats, 22; durum, 20; winter wheat, 40; hard winter wheat, 10; miscellaneous, 10. No. 3, approximate percentage: oats, 60; winter wheat, 35; rye, 5. No. 4, approximate percentage: winter wheat, 40; barley, 35; oats, 25.

* Considered the point at which the dust becomes sticky or congeals.

If the remaining dusts are grouped together, their temperatures must be raised over 700 Fahr. deg. (389 C. deg.) on vacuum lamps, over 600 Fahr. deg. (333 C. deg.) on the 75-watt and 100-watt gas-filled lamps, and over 500 Fahr. deg. (278 C. deg.) on the higher-wattage gas-filled lamps, before taking fire. No fires were started with any of these dusts on any of these lamps. Cornstarch in particular apparently melts into a crust and refuses to burn. Starch, graham flour, wheat flour and cornmeal all have a tendency to melt or congeal and form a crust which is difficult, if not almost impossible, to ignite except on a hot plate.

It is difficult to set definite workable limits between bulb temperature and ignition temperature which represent a safe difference, because if any dust is allowed to collect thickly enough and remain long enough a fire is almost sure to follow. As ordinarily used, however, all vacuum lamps operating around 150 deg. Fahr. (66 deg. C.) bulb temperature, and other units in this range of temperature, may be considered safe. The use of 75-watt and 100-watt gas-filled lamps with free ventilation would hardly be expected to cause a fire, but with drier dusts, larger wattages, or other changes in conditions the margin of safety might be so reduced as to cause a fire.

BREAKAGE OF BULBS OFFERS GREATEST POSSIBILITY OF DANGER

The second classification of fire possibility—that due to the breakage of bulbs in explosive atmosphere—is by far the more important of the two considerations. It has been previously shown that nearly all dusts having a high carbon content and being finely divided may be exploded by an open flame when such dusts are combined with air in the right proportion. This fact has been proved by co-operative tests between the United States Bureau of Agriculture and the United States Bureau of Mines. Their tests further showed that the electric arc or static electricity would produce an explosion. These facts have all been verified, and in addition it has been shown that explosions under the same conditions may be obtained when an incandescent lamp is broken or demolished in a dust cloud. Vacuum and gas-filled lamps will give the same results; the only exceptions noted so far have been with very low-wattage vacuum tungsten and carbon lamps. These lamps, however, are not excluded on this account, because much depends on the character of the dust cloud and the manner in which the lamps are broken. If the cloud has the proper proportions of dust and air, it is exploded when coming in contact with any lighted source such as a match, candle, lantern or other flame.

The breaking of incandescent lamp bulbs except by accident or careless usage is rare indeed. There are, however, certain practices in use in elevators which in view of the risk involved must be considered exceedingly dangerous. One of these is the lowering of an unprotected lamp bulb into an elevator bin to determine the amount of grain or feed it contains. The mechanical breaking of the bulb, or a short-circuit in the socket or wire, or the flash from a loose connection may easily be sufficient to produce a disastrous explosion under the right conditions. This and other similar practices should be prohibited.

There are on the market many types of so-called marine or vapor-proof fixtures which are designed for use in locations where explosive gases are prevalent or where the fixtures are subjected to moisture. Tests have been conducted on a few types of these fixtures to ascertain whether the temperature of the inclosing globe is sufficiently low to prevent the ignition of dust when gas-filled lamps are used. The tests conducted up to the present time indicate that globes having straight sides, which tend to prevent the accumulation of dust, may, if of sufficient diameter, be used with gas-filled lamps and yet maintain a temperature below the smoking temperatures given in Table I.

TABLE II—OPERATING TEMPERATURE OF BARE LAMPS *

Type of Lamp	Maximum Bulb Temperature, Deg. F.	Maximum Bulb Temperature, Deg. C.	Temperature Opposite Filament, Deg. F.	Temperature Opposite Filament, Deg. C.
Vacuum Lamps:				
50-watt	153	67	153	67
100-watt	152	67	152	67
150-watt	157	69	156	69
Gas-filled Lamps:				
75-watt	245	118	180	82
100-watt	259	126	178	81
150-watt	338	170	222	106
200-watt	327	164	222	106
300-watt	294	146	229	109

* Values are averages of several tests.

All incandescent lamps should be protected against breakage wherever there is danger of an explosive dust cloud. Good vapor-proof fixtures are a long step in the right direction, and their effectiveness can be increased by the use of a suitable wire guard or other protecting device. The point to be remembered is that it should not be possible for the filament of the lamp to become exposed to the dusty atmosphere under any conceivable condition.

Effective Oil-Switch Overhauling

Monthly Schedule of Maintenance and Repair Followed by Complete Dismantling and Realignment Yearly—Methods Used in Caring for a Typical Switch in a Large Pennsylvania Power Plant to Insure Maximum Operating Efficiency

By F. I. MORGAN
Pennsylvania Water & Power Company, Holtwood, Pa.

IN ORDER to maintain oil switches in a condition of maximum operating efficiency it is necessary to have a definite program for the care of such equipment. Careful periodic inspection and repair and a complete overhauling occasionally will be found well worth while from an operating standpoint. The Pennsylvania Water & Power Company has developed certain practices in handling this work, and although the method considered is for one type of switch the principles involved are applicable to other designs.

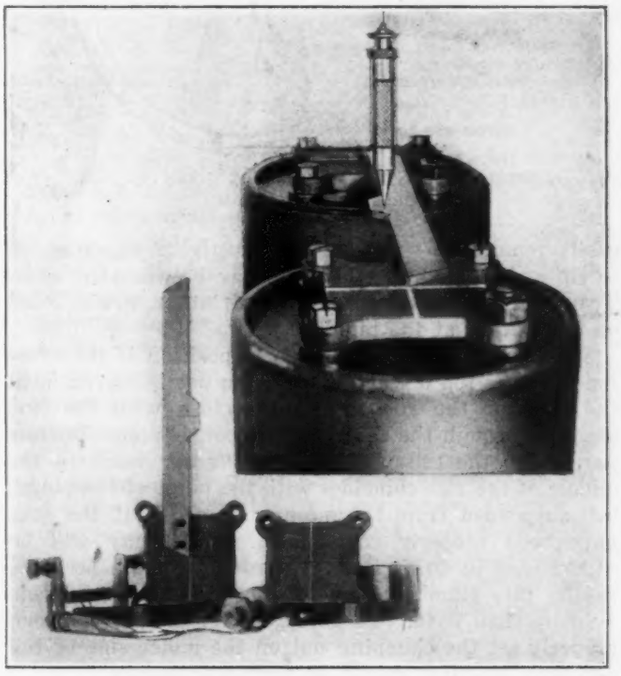
The oil circuit breakers in the Holtwood plant of the Pennsylvania Water & Power Company are General Electric type F, form H-3, rated at 300, 500, 800 and 2,000 amp. at 15,000 volts. All switches are inspected, cleaned and oiled monthly by the operating men. Any defects noted during these inspections, such as loose connections, slipping of clutches, unbalanced stroke, loose nuts, missing cotter pins, etc., are reported and promptly remedied by the maintenance department. Each switch is scheduled for a complete overhauling annually, and at this time pots are completely dismantled and cleaned, secondary contacts are dressed or replaced, and alignment of pots and mechanism is checked. The mechanisms are also taken down and all parts receive a thorough cleaning.

It frequently happens that when these switches are opened, as a result of relay action, considerable oil is spilled and the tips are burned off the contact rods. At the first opportunity after such an occurrence the contact rods are replaced by spares and fresh oil is substituted for the carbonized oil. In no case has it been necessary to remove the pots after such an operation because of damage to the secondary contacts. The oil level has been found to be from 3 in. to 4 in. (7.5 cm. to 10 cm.) low after particularly severe disturbances, but the average is from 1 in. to 2 in. (2.5 cm. to 5 cm.).

One of the safety rules of this company requires that no work shall be done on an oil switch until the mechanism has first been placed in the "open neutral" position. The wiring of the mechanism, as shown in the accompanying diagram, is so modified that this is very easily accomplished by removing the cartridge fuse, which prevents operation of the motor but allows the trip coil to be energized, and then short-circuiting the "opening" and "closing" wires.

Annual Overhauling Methods

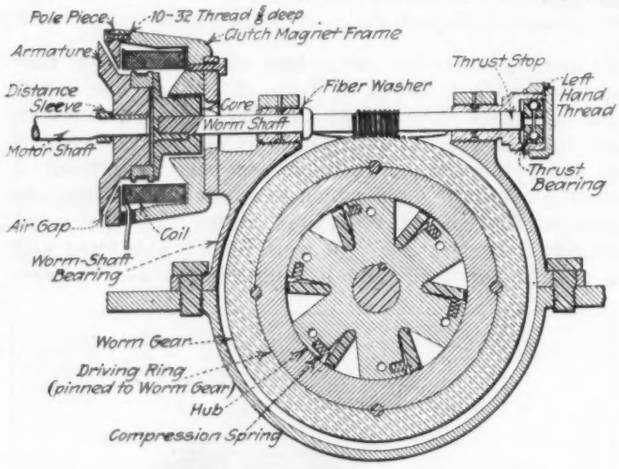
After removing crossheads, contact rods, etc., the oil is pumped out of all six pots. This is done by means of a hand pump, of the gear type, mounted on a small portable work table. Two tanks, each having a capacity sufficient to care for the oil from one switch—one for clean oil, the other for carbonized oil—are mounted on this table and connected by piping to the pump. Connection between the pots and pump is established by means of two lengths of oil-resisting hose, one for fresh oil and the other for carbonized oil. The suction hose is fitted with a length of ⅜-in. (9.5-mm.) pipe, which can be pushed through the secondary contact, thus permitting all oil to be pumped out. It was found necessary to equip the pump with a screen box, as without it small globules of brass which had been melted from the ends of the contact rods were drawn into the pump, making it inoperative. The work table is also fitted with a drawer for tools and a compartment for cleaning rags. After removal of oil the side bars are taken off, the clamp holding pots loosened and pots taken out. A set of spare pots is then installed, clamps are tightened and side bars replaced.



SPECIAL TOOLS ARE HELPFUL IN ALIGNING SWITCH POTS

In the beginning, when checking alignment or setting up a new switch, the back pot only is placed in each cell. This pot is first carefully leveled, the most successful method of doing this having been found to be by means of a 12-in. (30.5-cm.) level held against the front and side of the pot. Care must be taken to have the level in intimate contact with the pot throughout its entire length. It has been noticed that the machined contact surfaces on the cap are not suitable places for leveling as they become somewhat distorted when screwed into position. A form of level having a longitudinal groove in the center of its face is best for leveling purposes. Pots which are not plumb are made so by placing thin shims under the edges of the clamps which hold the lower porcelain bushing.

The pot is next centered and placed in correct position by the aid of an iron plate fastened to the cap by screws which enter the holes provided for the machine screws holding the top insulating bushing clamps. This device is made from ½-in. (12.5-mm.) boiler plate and has two center lines machined in its upper surface at right angles to each other and which cross at the exact center. A special rule made from tool steel is fastened to this plate and so mounted as to be easily removable. This rule is exactly 12 in. from tip to tip and is slightly wider midway between the ends. Two lines, at right angles to each other, are marked on its surface at the middle.



CAREFUL ATTENTION SHOULD BE GIVEN TO THE CLUTCH MECHANISM

This iron plate with the rule in position is then fastened to the top of the pot, and the pot is moved until the edge of the rule, which coincides with the line passing through the center of the pot, is approximately parallel to the cell walls and the center mark in the middle of the rule coincides with the point of the plumb bob suspended from the mechanism arm. If the cells have been properly constructed no difficulty will be experienced in doing this. In order to obtain accurate results this plumb bob should not clear the steel rule by more than 1/32 in. (0.8 mm.). After the pot has been properly set the clamping nut on the under side of the porcelain bushing should be tightened securely.

Next the steel rule is removed and the front pot placed in position and leveled. An iron plate similar to the one secured to the rear pot is placed on the cap of the front pot. It is very important that both pots be of the same height, and this is checked by means of the level. The center lines of the iron plates on the tops of both pots must coincide with the edge of the steel rule, which is replaced after the front pot is in position. This will insure the parallel arrangement of the contact surfaces on the tops of the two pots. As shown in the illustration, a mercury plumb bob suspended from a device mounted in the arm of the mechanism is used in aligning the pots. By means of this device the plumb line is centered with respect to the arm and the hole in the arm. A means of easily raising or lowering the plumb bob is provided by the roller on which the excess line is wound and which can be locked by a thumb-nut.

After the pots are correctly aligned the proper amount of oil is pumped into each and the crossheads and wooden insulating rods are replaced. The oil level is gaged by means of a wooden T-gage illuminated by a flashlamp. Crossheads are then checked to see that they are not bent or distorted in any way. The tips of the contact rods should be exactly 12 in. apart, and they should be parallel. Care must be taken before making this check to see that the rods are straight. If it is found that the crosshead is bent or distorted the fault is quickly located by so supporting the apparatus that the machined surface, against which the lower wooden-rod clamp is bolted, is level (checked with a small level) and then dropping a plumb line alongside the contact rods in succession.

ADJUSTMENT OF THE CONTACT RODS

The contact rods are so adjusted that the distance from the tip to the under side of the crosshead is 28 in. (71 cm.). In the old form of crosshead where the contact rods screw into position this is accomplished by means of a gage clamped to the rod by a setscrew. The rod is screwed up until the top of the gage is in contact with the under side of the crosshead. The gages, which are made of 1-in. wrought-iron pipe with slots cut in one side to allow their being removed from the rod, are placed in position after inserting the rod in a hole in the top of the workbench. The distance from the top of the table to the shelf on which the tip of the rod rests is 26 in. (66 cm.), and the gage, being 2 in. long, makes the distance from the tip of the rod to the upper end of the gage 28 in. (71 cm.), which is the proper length of that portion of the rod below the crosshead. For the 2,000-amp. switches the length of the rod below the crosshead should be 28¾ in. (73 cm.). The type of wrench used in handling brass pipe, with slight modifications, is used to screw the contact rods into position. With the later form of crosshead it is unnecesary to use gages on the contact rods since the sleeve can be correctly set before placing the rod in the crosshead.

The crossheads are so adjusted that the laminated contact brushes are held firmly against the contact surfaces of the cap. The solid brass piece on the under side of the laminations is made to clear these surfaces by approximately 1/32 in. The contact surfaces are lubricated with a slight amount of vaseline to prevent cutting. It is sometimes found that the end of the lower insulating rod clamp is not true with respect to the rod, which results in throwing the crosshead and contact rods out of plumb. This is corrected by machining the end of the clamp.

The crossheads on the 300-amp. switches are set by gage, as shown in the illustration. These crossheads cannot be properly adjusted by measuring between the top of the porcelain insulator and the under side of the crosshead since these insulators often vary in height above the cap.

OVERHAULING THE SWITCH MECHANISM

Before dismantling mechanism the tension of the springs is relieved by inserting a pin in the hole in the worm shaft and turning it backward the necessary degree. In case the springs are under too much tension the strain on the worm shaft is relieved by means of the ratchet wrench.

The ratchet can probably be considered as the most important part of the mechanism. It is completely disassembled and thoroughly cleaned. Several cases of failure of the mechanism to operate properly because of slipping of the ratchet have occurred, and this was

found to be due to the fact that the grooves in the pawls had become packed with particles of steel cut from the interior of the driving ring. This indicates the importance of periodic inspections.

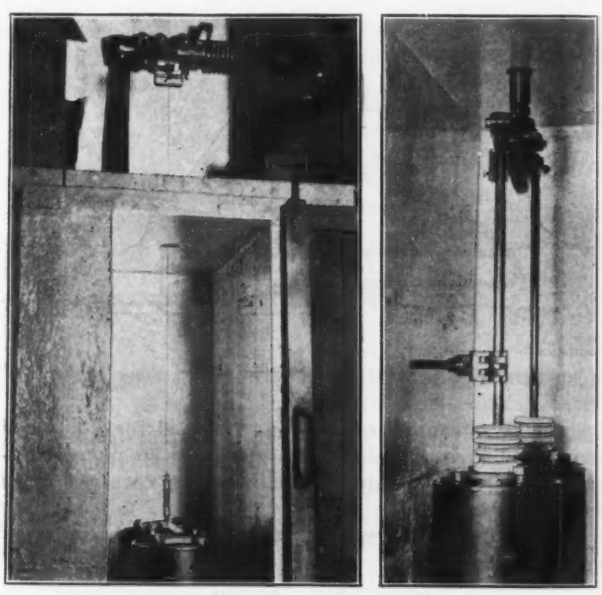
TEST MADE TO DETERMINE EFFICACY OF VARIOUS LUBRICANTS

A special test to determine the efficacy of various lubricants for the ratchet was made on one of these switches, and as a result an engine oil was adopted for this purpose. Careful micrometer measurements of the internal diameter of the steel driving ring were made, and it was found that this diameter had increased, owing to wear, from two to three thousandths of an inch after 2,200 operations of the switch.

The ball thrust bearing on the worm shaft is taken apart and cleaned, afterward being lubricated with vaseline. The cap on this bearing must be screwed up tight, because if this be not done it may work partly off (as actually occurred in one instance) and allow the clutch armature to lock against the clutch coil frame, preventing normal operation of the switch.

Careful attention is given to the friction clutch since it is sure to give trouble if it is not correctly adjusted. Some of the causes of slipping of these clutches are: (1) Friction ring loose or incorrectly proportioned; (2) misalignment of motor and worm shafts; (3) the face of the worm-shaft core may not be true; (4) a loose worm-shaft bushing will sometimes result in clutch trouble; (5) air gap may be too great (maximum $\frac{1}{16}$ in., minimum $\frac{1}{32}$ in.); (6) defective clutch coil; (7) bent motor or worm shaft.

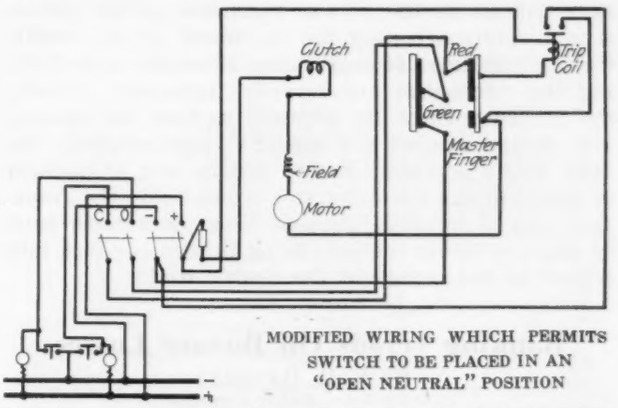
Wooden friction rings are bought in the rough, and



EXTREME CARE IS NECESSARY IN THE PROPER ALIGNMENT OF SWITCH POTS

before turning to a driving fit they are thoroughly dried out. After the armature has been fitted with the new ring it is placed on a mandrel and swung between the centers of a lathe. A groove for the banding wire is then cut in the outer surface of the ring, after which it is tightly banded with several turns of No. 17 B. W. G. steel wire. This banding wire is wound over narrow pieces of sheet brass spaced at intervals of 120 deg. around the circumference of the ring. After the banding wire is in place the ends of these brass strips are turned over the band and soldered. A minimum section of the band is heated, as otherwise the wire will stretch, rendering the band useless.

The face of the friction ring is turned true *after* the banding is done, since this process is very apt to distort the ring to some extent. The face of the ring is turned off until slightly less than $\frac{1}{32}$ in. of the wood projects beyond the iron. This dimension is important because



MODIFIED WIRING WHICH PERMITS SWITCH TO BE PLACED IN AN "OPEN NEUTRAL" POSITION

slipping will result if the friction ring projects too far beyond the iron.

A sliding fit must be maintained between the clutch armature and the motor shaft, and this must be remembered when changing these armatures.

The following lengths of clutch air gap have been adopted: Minimum, $\frac{1}{32}$ in. (0.8 mm.), maximum $\frac{1}{16}$ in. 0.48 mm.). If the air gap is made less than $\frac{1}{32}$ in. there is danger that the clutch armature will lock against the clutch-coil housing if the friction ring becomes badly worn. Care must be taken when adjusting the air gap to avoid forcing the worm-shaft core against the end of the motor shaft.

Probably the most convenient means of checking the alignment of the motor and worm shafts is by the use of a dial test indicator having a pointer and dial graduated in thousandths of an inch. Care must be exercised in using this gage since play in the front worm-shaft bushing is liable to result in false indications. Before making this check it is of course necessary to remove the clutch coil housing and the worm-shaft core. The same method is used in checking the worm-shaft core.

Oil often leaks around the plugs in the motor bearings, and this is remedied by removing the plugs and treating them with thickened shellac before replacing. All contact surfaces of the cam-operated fingers are cleaned and bearing surfaces lubricated with vaseline. The screws passing through the insulating sleeves in these fingers are tried to insure their being tight. Grounds on the control circuit have been caused by these screws working out of place.

The toggle in the older types of mechanisms requires especial attention. Any defect at this point may result in "pumping" of the mechanism. All toggle links are cleaned and pins lubricated with vaseline. One case of "pumping" was remedied by filing the brass piece immediately above the trip-coil plunger, thus allowing the toggle to be thrown slightly farther "over center" and making it less sensitive. However, this filing must be done with caution. Dirt in these parts will introduce friction, making the action stiff, preventing the toggle from returning to its proper position, and

"pumping" will result. Broken or weakened toggle springs also cause this trouble. Binding of the trip coil plunger will sometimes prevent the toggle from returning to its proper position. Of course, the later types of mechanism, equipped with the "positive toggle latch," are entirely free from this defect.

Before dismantling the "double reduction" type of mechanism the gear and pinion are marked, since if they are incorrectly meshed the dog on the crankshaft gear will strike the keyway extension on the pinion, thus violently arresting the movement of the switch. During the course of overhauling all anchor bolts holding the mechanism are securely tightened. Finally, the torsion springs are adjusted so that the opening and closing strokes are made in approximately the same length of time. Before making any adjustment to these springs the roller stop which holds the crankshaft dog is carefully blocked. Due precautions must be taken to insure the rods being thrown one inch into contact by the springs on the closing stroke.

Banking versus Oil Burner Losses

BY F. H. DANIELS
Sanford Riley Stoker Company

IN COMPARING the operating costs of coal-burning and oil-burning plants the banking losses of the coal plant should be balanced against the steam required by the oil burners. Where the load factor is high the loss is in favor of coal burners, and with low load factor oil burners have the advantage. For instance, in the case of a stoker the coal consumption on a banked fire is approximately 30,000 B.t.u. per square foot of grate surface. With 14,000 B.t.u. coal this would amount to 2.15 lb. per square foot of grate surface per hour. If we consider a 500-hp. boiler with a grate surface of about 80 sq.ft., the coal used per hour would amount to 172 lb., equal to 2,400,000 B.t.u. per hour.

The additional steam required to operate the oil burners amounts to approximately 4 per cent of the boiler output. Consider this same 500-hp. boiler fired with oil and operating at 200 per cent of rating. The steam required by the oil burners would amount to about 40 boiler horsepower. This would mean an input to the boiler of 1,800,000 B.t.u. per hour for operating the burners. If the boilers were banked 43 per cent of the time and were operating at 200 per cent of rating for 57 per cent of the time, the loss during a day's run from the steam required for oil burners would be equal to the loss brought about by banked coal fires under the same condition of load.

Remodeling Stokers and Furnaces Adds to Capacity

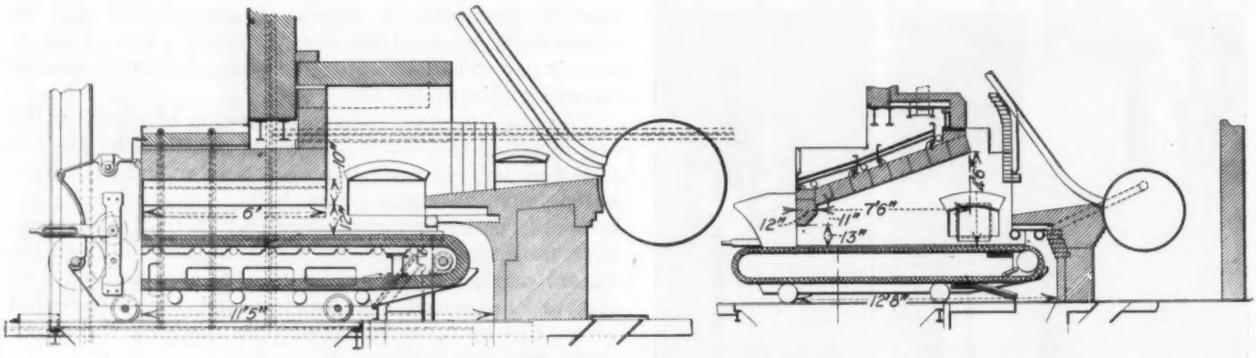
Boiler Ratings Raised 39 per Cent by Enlarging Grate Areas and Improving Arch Design—Practical Method at Minimum Cost

BY T. A. MARSH
Chief Engineer Greene Engineering Company

BOILER, furnace and stoker design of ten to fifteen years ago was based on ability to obtain 125 to 175 per cent rating. Present-day practice is to operate normally at from 150 to 200 per cent rating and to swing peaks beyond this rating as may be demanded. Many stations installed several years ago are remodeling their furnaces and enlarging their stokers in order to obtain ratings consistent with modern practice. A typical instance of this procedure has occurred at the Muncie (Ind.) plant of the Indiana General Service Company.

The original installation of boiler-room equipment at this plant consisted of the following units: Two class "S" No. 25 Stirling boilers, 500 hp., served by two 9.5-ft. x 10-ft. (2.9-m. x 3-m.) Green chain grates, and four Edge Moor boilers, 500 hp., also served by 9.5-ft. x 10-ft. Green chain grates. Draft is provided by a concrete chimney 14.5 ft. (4.5 m.) in diameter and 250 ft. (76 m.) high, capable of providing a draft to the furnace of the most remote boiler of 5 in. (1.27 cm.).

Situated as Muncie is, close to the coal fields of Indiana, such coals as Indiana Nos. 3, 4, 5 and 6 veins are the natural fuel. The station as originally designed was capable of handling the load for a number of years, but as the plant load increased steam requirements went up and higher ratings were required from the boilers.



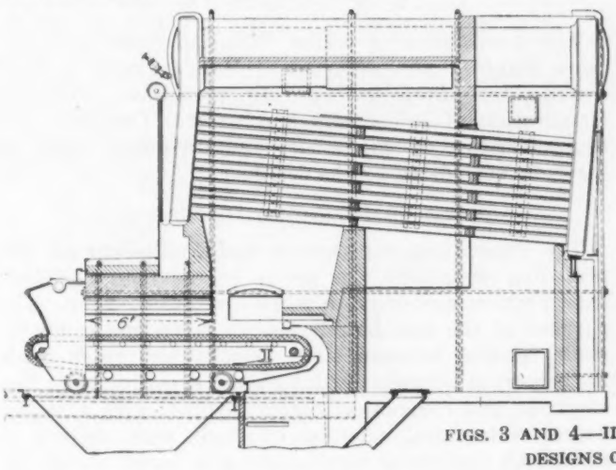
FIGS. 1 AND 2—IGNITION ARCH AND FURNACE DESIGN IMPROVEMENT POSSIBLE IN RECONSTRUCTION WORK

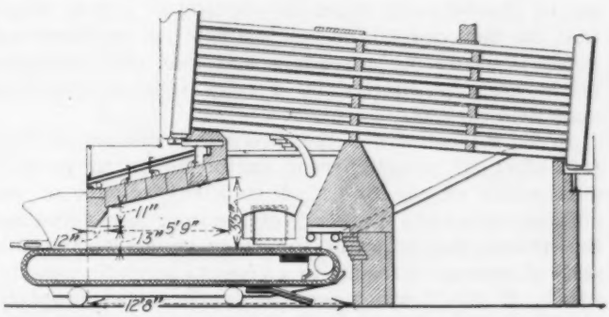
Typical test performances of the original installation are given below:

Type of Stoker	Green Chain Grate	Green Chain Grate	Green Chain Grate
Draft over fire, in.	0.58	0.39	0.43
Kind of fuel	Hocking slack	Indiana screenings	Indiana screenings
B.t.u. per lb.	11,585	10,908	11,656
Coal burned per hour per square foot grate surface, lb.	32.2	31.4	33.6
Per cent rating	144	123	144
Net combined efficiency of boiler and furnace, per cent	75.7	70.6	73.8

The combined efficiency of boilers and stokers was high and resulted in excellent station performance, and the rating 144 per cent was consistent with the practice

at the time when the installation was made. As the station load grew additional boilers and stokers were added to meet the increased steam demands until the entire available boiler-room space was filled. Then came a consideration of how to obtain increased capacity from the existing boilers. To do this, two broad methods were open: (a) To burn more coal; (b) to burn higher grade fuel. Freight rates and costs at the mine prohibited the burning of higher grade fuel, therefore the problem became one of burning greater quantities of Indiana coal.





FIGS. 3 AND 4—ILLUSTRATION OF WHAT CAN BE ACCOMPLISHED IN IMPROVING DESIGNS OF SETTINGS. (3) OLD AND (4) NEW BOILER SETTINGS

In order to burn more coal two methods were open: (a) Increasing the rate of combustion per square foot; (b) increasing the grate area.

On account of the low fusing temperature of the ash of Indiana coal and the high percentage of ash, higher rates of combustion, such as might be obtained with forced draft, were considered an undesirable operating feature as abnormal clinker trouble would be encountered. Burning more coal would also cause increased furnace maintenance costs, and the ultimate benefits were doubtful. It was therefore decided to increase the coal burning ability by increasing the grate surface. Fortunately the furnace space of the Edge Moor and Stirling boilers was considerably greater than the stoker width, and it was readily possible to increase the width of the stokers, and in fact an advantage to do so, as the heat distribution under the first bank of tubes could be thereby improved. Figs. 1 and 2 show the changes in the Stirling boilers, while Figs. 3 and 4 are for Edge Moor boilers.

Installation	Type of Boiler	Rated Hp.	Grate Size, Ft.	Grate Area, Sq. Ft.	Grate Ratio Surface to Heating Surface	Per Cent Increase in Grate Surface	Hp. Developed	Per Cent Increase in Capacity	Diameter of Furnace
Original Sterling		500	9.5x10	90.3	1 to 55.5	....	720	..	Fig. 4
Revised Stirling		500	10.5x11	133.2	1 to 35.2	47.5	1,000	39	Fig. 3
Original Edge Moor		500	9.5x10	90.3	1 to 55.5	....	720	..	Fig. 1
Revised Edge Moor		500	12x11	128.0	1 to 35.2	41.8	1,000	30	Fig. 2

The location of bridge walls permitted also the increasing of the stoker length, so it was decided to increase the grate surface the maximum amount possible by both widening and lengthening the stokers.

The accompanying tabulation indicates the relative dimensions, proportions and results obtainable from the original and the enlarged stokers.

Evaporative tests have not been made on the units on which the grate surface has been increased, but from flow-meter and Venturi meter readings it is evident that the boilers operate at 200 per cent capacity in daily operation, which is a more important consideration than test performances. The Indiana General Service Company was so well satisfied with the performance of the first units on which the grate size was increased and the furnaces improved that it quickly proceeded in a similar manner with the other units in the station.

This is a typical case of a station designed twelve or fifteen years ago, and operated at boiler ratings of from 125 to 150 per cent, being reconstructed to obtain ratings of 200 per cent and over. Usually the easiest and cheapest method of doing this is by increasing the grate surface and modernizing the furnace.

With chain grates it is possible to improve the arch design so that much higher rates of combustion can be obtained and so that the ignition is never weak and is never the limiting factor as regards capacity.

Many stations, both of the public utilities and of the industrial plants, have made similar changes in grate size and in furnace design and have realized increased capacity similar to that obtained by the Indiana General Service Company.

With present costs of new equipment the cheapest way to obtain increased capacity is by means of making furnace improvements if such are possible. In this case by the small expenditure for the necessary repair parts to increase the stoker size an additional capacity of 1,500 hp. was obtained at about 20 per cent of the cost of installing additional boiler capacity.

Fireworks on a 250,000-Volt Insulator

THE beautiful electrical display here shown took place when a wet arc-over at 485,000 volts was developed on a General Electric 250,000-volt porcelain bushing. This is the type of bushings that is to be used on the 220,000-volt Southern California Edison system.

Starting Synchronous Motors Under Load

Investigation of the Variation of Pull-in Torque to Determine Procedure in Starting by Induction-Motor Action

BY E. E. GEORGE
A. L. Drum & Company, Chicago, Ill.

IMPORTANT considerations in starting synchronous motors by induction-motor action to avoid excessive currents and mechanical strains were brought out by the writer in a previous article.* It was shown that the behavior of the field ammeter is an important guide in operating procedure and that this operation might even be effected by a relay scheme depending upon field current.

It is evident from the preceding discussion that the effect of direct-current excitation is to produce a vibration of the rotor. A sufficient amount of excitation makes the frequency of the impressed force and the natural frequency of the rotor resonant, and this state of resonance results in a violent change in velocity, which, if the frequencies are synchronized properly, results in the rotor attaining synchronous speed smoothly and almost instantly. That is, the rotor "hunts" up to synchronous speed when the field is thrown on.

INFLUENCE OF DESIGN ON PULL-IN TORQUE

The preceding article gives sufficient information to the engineer in charge of installation, operation and maintenance to enable him to utilize the inherent starting qualities of any synchronous motor to the best advantage. In some cases he will be able to start twice the loads previously attempted. However, nothing has been advanced so far that would aid the designer in improving the starting qualities of synchronous motors. The designer has control over certain factors that affect the pull-in torque. Chief among these factors are field current, line current, moment of inertia of rotor and load, and slip before excitation (at highest induction speed under given load). The load torque may be negligible as compared to its inertia, as pointed out by Steinmetz, because the time taken by the rotor from excitation to practically complete pull-in is very short under favorable conditions—less than the initial slip cycle. The following equation represents (with the limitations discussed later) the relation which must be attained for the rotor to pull into synchronism under the most favorable conditions of switching:

$$\omega_g - \omega_e = 2\sqrt{\frac{1650 \times P_p^2 \times K_m \times E_g \times I_d}{746 \times \text{mass} \times r^2 \times Z_g}}$$

This can be reduced to:

Initial slip =

$$\text{constant} \times \sqrt{\frac{\text{line current} \times \text{field current}}{\text{moment of inertia of rotor and load}}}$$

The above equality can be obtained by decreasing the slip (increasing the induction-motor characteristics), or by increasing the natural frequency of the rotor (which is a function of the elasticity of the magnetic circuit and the moment of inertia of the mechanical construction), or by both methods.

*ELECTRICAL WORLD, April 10, 1920.

Decreasing the initial slip is usually permissible, but it slows up the latter part of the pull-in very appreciably, as may be seen from the two equations following:

$$\omega_g - \omega_m = \frac{(\omega_g - \omega_e)}{\cosh\left[\frac{(\omega_g - \omega_e)\ t}{2}\right]}$$

$$\frac{(\omega_g - \omega_e)\ t}{2} = \log_e \tan\left(\frac{\rho_m}{4} + \frac{\pi}{8}\right)$$

The Amortisseur Winding Which Prevents a Rotor from Hunting at Synchronism May Prevent It from Pulling Into Step Quickly.—In connection with the equalization of initial slip and natural frequency the characteristics of the amortisseur winding must be carefully considered by the designer.

BASIS OF PRECEDING DISCUSSION

The derivation, explanation and limitations of the preceding equations are given below, not in detail, except where necessary to make limitations clear. The purpose of the mathematical work is to find some explicit relation between time, velocity and rotor angle in the period between excitation and synchronism. The magnetic and mechanical forces involved give a second degree differential equation of angle with respect to time. All the preceding discussion is based on the results of the integration of this equation. The key to the method of integration was the result of reconciling Blondel's statement of the forces involved with the dynamical laws of vibration, with Routh's investigation of the stability of steady motion, and with some observations of the writer that indicated that pull-in was a "hunting" or vibratory phenomenon.

Notation:

ρ_m is the angle, in electrical radians by which the axis of the direct-current field of the rotor lags behind the axis of the same-signed rotating field of the stator.

ρ_s is the value of ρ_m after the machine has reached synchronism and settled down to its final phase position.

ρ_e is the value of ρ_m when excitation is impressed.

E_m is the induced or the motor emf. in effective volts to neutral for phase 1, and taken in such a direction as to be a counter-emf. under normal operating conditions (motor torque).

E_g is the supply or generator emf.

e_m is the instantaneous value of E_m.

e_g is the instantaneous value of E_g.

I_a is the alternating current, in effective amperes, induced in the motor-field circuit.

I_d is the direct current impressed on the motor field circuit.

I_m is the current in phase 1, in effective amperes, due to E_m acting on Z_m.

I_g is the current in phase 1, in effective amperes, due to E_g acting on Z_g.

i_m is the instantaneous value of I_m.

i_g is the instantaneous value of I_g.

$r^2 \times$ mass is the equivalent moment of inertia ($= r^2 \times$ weight $\div$ 32.2) of the rotor and load (r in feet, weight in pounds).

t is the time in seconds, after $\rho_m = \rho_e$.

T_1 is the torque in watt-seconds due to phase 1.

T_m is the torque due to all phases.

ω_m is the velocity, in electrical radians per second of the rotor.

ω_g is the velocity of the stator rotating magnetic field.

ω_e is the value of ω_m when excitation is impressed.

U_g is the impedance of the system per phase to neutral at ω_g, including motor, generator and line.

Z_m is the impedance at ω_m.

ϕ_g is the power-factor angle for Z_g in radians.

ϕ_m is the power-factor angle for Z_m.

θ_e is the angle, referred to $\omega_g t$, in electrical radians, by which e_m lags behind e_g when excitation is impressed.

θ_s is the value of θ_e when $\rho_m = \rho_s$.

P_p is the number of pairs of poles on the motor.

β = integral of $(\omega_m dt)$.

A is a measure of the natural rate of vibration of the rotor for given magnetic and mechanical constants.

$$A = 2\sqrt{\frac{1650\ P_p^2\ k_m\ E_g\ I_d}{746\ \text{mass}\ r^2 Z_g}}.$$

D is a measure of the forced rate of vibration of the rotor for given values of slip, angle and A.

$$D = \sqrt{(\omega_g - \omega_e)^2 - \frac{A^2}{2}\sin\rho_e + \frac{A^2}{2}}.$$

Since $D = A = \omega_g - \omega_e$ at "critical" pull-in, D and A are angular electrical velocities, and if divided by 2π would represent electrical cycles per second.

k_m is the ratio of E_m to $I_d\ \omega_m$. It will be taken as constant during integration.

Physical Basis of Motor Torque

The chief torque on the rotor of a normally operating synchronous motor is due to the reaction between the current in the stator windings and the magnetic field due to the rotor windings, or vice versa. While under some conditions all electrical motors have a torque due to longitudinal tension of the lines of force in the air gap the greatest torque is that due to current-carrying conductors on one element being in a magnetic field due to current-carrying conductors on another element, with freedom of motion between the elements. In analyzing synchronous motor torque, the common explanation, involving attraction between the magnetic poles of the rotor and stator, must be laid aside. Torque should be evaluated from the power equation. Torque equals power divided by angular space velocity. The instantaneous value of power equals the product of the voltage and the current at that instant, provided that the voltage is a measure of the magnetic field acting on the conductors carrying the current. When the current is in phase with the voltage, the product is positive, denoting generator action or decelerating torque.

Construction of Torque Equation

The part of the rotor-field flux due to the induced current I_a in the rotor causes an induction-motor torque, to which the ordinary induction-motor equations for one phase of a phase-wound rotor are applicable. The part of the rotor field flux due to the direct-current excitation I_d causes the induction of a voltage E_m in the primary. This voltage E_m causes a current I_m in the primary, in addition to the current I_g due to E_g. As we have seen that the torque on the rotor is due to the stator current and the rotor field, and that E_m is a measure of that field, we may write, following Blondel:

$$T_1 = -P_p\ (e_m\ i_m + e_m\ i_g) \div \omega_m.$$

The minus sign is used because we will consider accelerating or motor torque as positive, contrary to the usage in the power equation. ω_m, which is an electrical velocity, must be divided by P_p to get a space velocity.

Taking the zero value of e_g in phase 1 as the zero of time:

$$e_g = \sqrt{2}\ E_g \sin\ (\omega_g t).$$
$$i_g = [\sqrt{2}\ E_g \sin\ (\omega_g t - \phi_g)] \div Z_g$$

As ω_m is a variable, e_m is not a linear function of sin $(\omega_m t)$.

$$e_m = \sqrt{2}\ E_m \sin\ (\int \omega_m dt - \theta_s) = \sqrt{2}\ E_m \sin\ (\beta - \theta_e).$$

$$i_m = [\sqrt{2} E_m \sin\ (\beta - \theta_s - \phi_m)] \div Z_m.$$

$$T_1 = -\frac{2\ P_p\ E_m\ E_g}{\omega_m\ Z_g} \sin\ (\omega_g t - \phi_g) \sin\ (\beta - \theta_e) -$$

$$\frac{2\ P_p\ E_m^2}{\omega_m\ Z_m} \sin\ (\beta - \theta_e - \phi_m) \sin\ (\beta - \theta_e).$$

Considering a three-phase machine, with phases 2 and 3 of E_g respectively $(2\pi \div 3)$ electrical radians ahead of and behind phase 1 as to time, phases 2 and 3 of E_m are respectively $(2\pi \div 3)$ $(\beta \div \omega_g t)$ electrical radians ahead of and behind phase 1 as to time.

As the sum of the cosines of three angles differing by $(4\pi \div 3)$ is zero, some of the terms drop out when the total torque for the three phases is considered. As in all practical cases the induction torque of the rotor is able to bring it within a small fraction of synchronism, we may make a simplification of some of the other terms for three phases. Even with a slip of 10 per cent $(\omega_g - \omega_m = \omega_g \div 10)$, the integral over a slip cycle $(\omega_g t - \beta = 2\pi)$ of the sum of the sines of three angles differing by $[1 - (\beta \div \omega_g t)]$ $[2\pi \div 3]$ radians is within 1 per cent of the integral of three times the sine of the middle angle. For the net torque of three phases:

$$T_m = -\frac{3\ P_p\ E_m\ E_g}{\omega_m\ Z_g} \cos\ (\omega_g t - \beta + \theta_s - \phi_g) -$$
$$\frac{3\ P_p\ E_m^2}{\omega_m\ Z_m} \cos\ (-\phi_m).$$

At synchronism $(\omega_g t - \beta + \theta_e)$ becomes θ_s:

$$-T_s = \frac{3\ P_p\ E_m\ E_g}{\omega_m\ Z_g} \cos\ (\theta_s - \phi_g) + \frac{3\ P_p\ E_m^2}{\omega_m\ Z_m} \cos\ (-\phi_m).$$

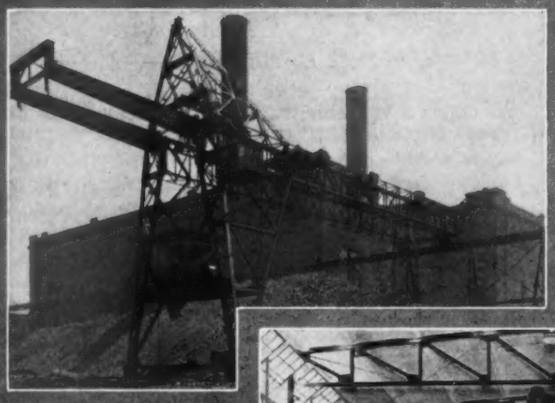
As ϕ_m is always less than 90 deg., being a power-factor angle, cos $(-\phi_m)$ equals cos ϕ_m.

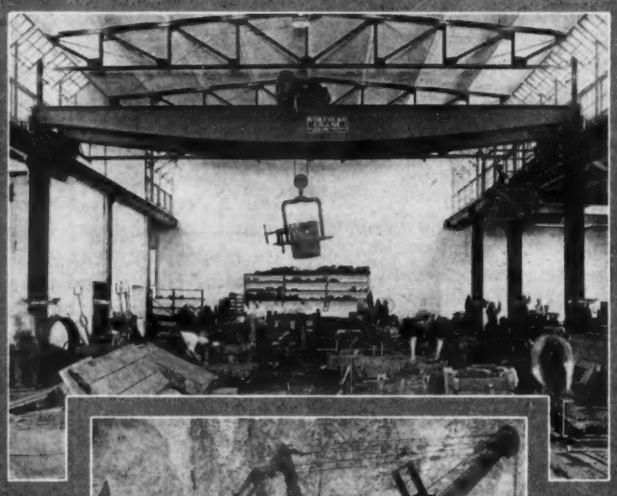
$$-\frac{s\ \omega_m}{P_p} = \text{power} = \frac{3\ E_m\ E_g}{Z_g} \cos\ (\theta_s - \phi_g) +$$
$$\frac{3\ E_m^2 \cos\ \phi_m}{Z_m}.$$

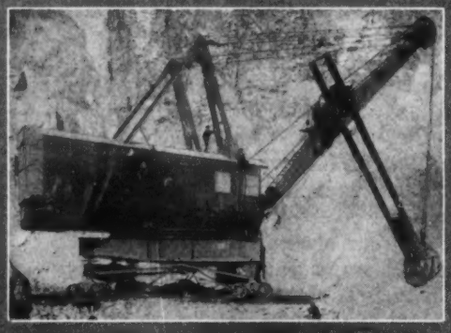
With a suitable change in notation, the above will be recognized as the standard equation of synchronous motor output.

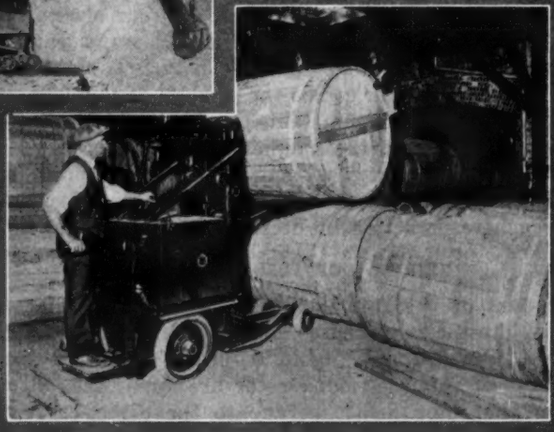
The discussion of this subject will be completed in an early issue.

Modern Methods Used in Material Handling









Electricity has played an important part in the development of material-handling methods and machinery. The central station engineer has realized the efficiency of modern handling methods and hence the coal crane is now a common installation. In the factory orderly progress of materials is maintained with conveyor systems. The foundry benefits by the ease with which crucibles and other heavy loads are handled, while giant shovels such as those used by the Chile Exploration Company or the Ontario Hydro-Electric Commission scoop the earth's surface at a rate never before dreamed of. Trucking and stacking have become an interesting occupation instead of one where the inefficiency of brute strength formerly predominated. All of these have been advanced by electric power.

Economies in Handling Materials in Industrial Plants

Instances of Savings Effected by Electrically Operated Material-Handling Machinery and Examples of Adaptation to Cover Varying Needs

By J. S. Tuthill
Assistant Secretary-Manager Material-Handling Machinery Manufacturers' Association, New York

IN INDUSTRIAL plants attention is being concentrated on "progressive-production" methods by which the use of electrically operated material-handling machinery results in quick and efficient performance. Since the major portion of these devices are electrically operated, it would not be worth while to try to draw comparisons with equipment using other motive power, but to show the great savings effected by substituting mechanical methods for man power allusion to a few installations which are fairly representative of the tendency in the use of these devices will be of interest.

In handling bales of cotton the load-carrying electric truck carries ten bales per load with more speed than one man can carry one bale. The use of these trucks for handling cotton has released hundreds of men for more important work requiring individual service. At one of the big rubber factories in Ohio electric trucks haul loads of 3,100 lb. (1,400 kg.) each trip and make one trip around the department every four minutes. In an average eight-hour shift a truck pulls more than 200,000 lb. (90,000 kg.) of tires and cores, doing work that formerly required the time and energy of twenty-five men. The shops of a railroad in the East have in service four load-carrying trucks and one tractor, and these have displaced twenty-five men with hand trucks, eight horses or mules with drivers and the services of a switch engine for two hours per day, showing a saving over the former method of handling of $34,363 a year.

Savings Effected by Overhead Trolley Conveyor Paid for Installation in Six Months

In the warehouse stockroom of a big brass and copper company material was handled and moved manually in loads averaging about 700 lb. (300 kg.). Recently an overhead trolley conveyor system was installed, costing $700. Reports indicate that the conveyor paid for itself in direct saving in less than six months, and in addition it has released two men for other important work. This installation has also eliminated the annoyance caused the management by having frequently to employ extra men for days or weeks when much material was moved and the work was unusually heavy.

While working both night and day shifts, a large beet-sugar company was confronted with the problem of adequately storing the sugar after it had been bagged. For years the bags of sugar had been trucked by hand across an immense warehouse. Later they were piled by hand, fourteen men being required for each shift, or twenty-eight in all. Finally this company purchased 200 ft. (60 m.) of sectional electric conveyor and an electric portable piling machine. The system is unusually flexible, and when the stacking is done the units of the conveyor may be shifted about to carry sugar, beet pulp or beet seed directly into railroad cars, to motor trucks or any other point desired. Furthermore, the installation has released twenty men for more important work, and, instead of fourteen men on each shift, the present arrangement necessitates the use of but four, and these four exert only half the physical effort that was formerly required of them.

The handling of heavy pieces of scrap in storage yards is easy for a locomotive crane equipped with an electric magnet, whereas by hand this work could not be done at all. With a 10-ton to 20-ton locomotive crane and electrically actuated magnets a 50-ton car can be loaded in thirty minutes by handling pieces of iron and steel weighing 3 tons each trip. These cranes also do the car switching in the yard and they can travel at a speed of eight miles per hour. Though handling scrap is the main job of the cranes, they are also employed for handling coal and similar material in bulk. It is only the work of a few minutes to take off the magnet and hang a 1.5-cu.yd. (1.15-cu.m.) clamshell bucket in its place.

Electric Hoist Causes Reduction in Clerical Force of Cleveland Street Railway

A recent and most novel installation of handling machinery is that of the Cleveland Street Railway Company. By a system of automatic machines in conjunction with an overhead electric trolley hoist, the company's receipts of tickets and currency are sorted, counted, wrapped, and finally transported to proper storage, entirely by mechanical means. Formerly this process required the services of a whole clerical force, but now human labor is virtually dispensed with.

Automobile manufacturers have taken noticeable steps in developing efficient material-handling methods. Throughout their plants and factories such companies as Ford, Studebaker, Buick and others are effecting great economies by the use of electromechanical instead of manual methods. Use is made of numerous locomotive cranes in storage yards to handle raw materials and of traveling cranes to deliver goods direct from railroad cars to the receiving rooms and also to deliver finished product from plant to railroad cars. In machine shops and assembly rooms, to save all handling and movement of the parts, conveyors of the belt and chain trolley types having a continuous movement are used. Where many very small parts are to be handled belt conveyors up to 24 in. (60 cm.) in width are installed, on which two rows of small parts may travel simultaneously, or small boxes containing parts in quantities may be conveyed.

Another operation which deserves mention is the handling of material in skylight-inclosed crane bays, connecting two buildings of two or more stories. The cranes in these bays are of the electric traveling overhead type, spanning the distance between the buildings. On the ground floor there are standard-gage railway tracks running into this sky-lighted areaway between the buildings, so that goods may be brought in in railroad cars and handled under cover in all kinds of weather. From the sides of each of the buildings there are numerous projecting box platforms with wide doorways into the building proper. These platforms are so inclined on the different floors that the overhead traveling cranes may take goods from the platforms between the cars, lift them rapidly to the proper story, travel along to the box-projecting platform where the goods are nearest the point of destination, and then swing the goods to the projecting box platform and drop them onto a trailer truck which has been run out from inside the building. When trailer trucks are used to

receive the loads which are lifted by the crane, the trailers are towed by electric storage-battery tractors or electric industrial trucks to the place on that floor where the goods are to be stored or used.

Many more instances of distinct savings effected by electrically operated material-handling machinery could be cited. These few, however, will serve to suggest the tremendous opportunities to conserve time, labor and money and promote efficiency in the handling of materials.

Improvement of Interconnection by Liberal Co-operation

Team Work in Spirit as Well as by Contract Among the Connected Systems—Unified Scheme Under One System Operator as Goal

BY A. T. THROOP
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HOW shall two or more electric utility companies contemplating interconnection establish a system of operation that will yield maximum benefits to all interests concerned? Has experience with the commercial and engineering sides of interconnection been sufficient to enable standards of practice to be laid down for general guidance? These questions lead to a few broad comments upon certain fundamental aspects of the interconnection problem which should not be overlooked by those about to enter this promising branch of electrical service.

Above all, the contracting parties should enter into the agreement with a spirit of generous co-operation and the aim should be to work toward the operation of the combined systems as a complete unit. The working out of an interconnection problem must utilize the best results of experience in accord with certain underlying principles if success is to be attained, leaving room for variations in treatment when necessitated by differences among local conditions.

Real co-operation must be agreed upon and practiced among the several companies interconnected if maximum efficiency is to be attained. The parties concerned should enter into an agreement to submit their plants and lines as a group to scientific management with respect to co-operative handling of loads, interchange of energy and equipment direction. The limits of responsibility for the control of operations, inspection and maintenance should be clearly established. Contracts vary widely as to scope. Whether these be elaborate or simple, they must be drawn in a co-operative spirit and carried out with team play as their primary incentive if the best results are desired. Sharp bargains, close cutting of interpretations, narrow and selfish viewpoints are inimical to the maximum efficiency of interconnected service. Fair profits on energy interchanged, or economic advantages reckoned and accepted among the parties to interconnection agreements, are reasonable objects, but local jealousies and rivalries have no place in the working out of such arrangements. In effect, parties to an interconnection agreement enter a species of partnership to pool their resources in the way of efficient handling of loads, and unless confidence is established and maintained the results are bound to be far below the possibilities.

In some cases interconnection arrangements may proceed upon the basis that each company operates its own plants and lines independently of the other, with the exception that stated amounts of energy can be transferred back and forth when stated conditions exist. The larger the ratio of interconnected energy transfer to the output of the individual plants, however, the more important it becomes that the operating problems of the several stations be intelligently and positively co-ordinated. Complete control of plant operations may ultimately be vested in a single system operator; but whether this be done or not, entire frankness is the price of satisfactory interplant administration.

If interruptions occur, full and prompt reports of their cause and remedy should be interchanged or turned in to the responsible system operator in charge of service, and great care should be taken to avoid incomplete reports. Fear for blame for troubles of operation should never be allowed to interfere with the open-handed transmission of information from local plant operating shifts to the dispatching center or from equals to equals who are striving to operate the complex properties under their control at maximum efficiency.

GOOD TELEPHONE SERVICE IS ESSENTIAL

Leased telephone connections operated by the local telephone interests are usually a vitally important feature of a first-class interconnection. The saving in time resulting from available leased lines run so far as practicable apart from the transmission lines of the related companies deserves particular emphasis. Modern load dispatching requires quick and accurate interchange of orders and information, and delays are often costly in their inconvenience to the public and in loss of prestige by the companies. Plants of major importance should therefore be provided with adequate personnel to insure the prompt handling of all telephonic business without those delays due to coincident operating work required to be performed by those on duty. Unless an interconnection warrants paying for this extra operating force, at least during the day and evening shifts, it is unlikely that an interplant tie service can be economically justified. The repeating back of all transmitted instructions as in transportation practice is very desirable in the interest of safety and service continuity.

Visits of plant operators between interconnected stations, the interchange of operators among tied-in systems, regular meetings of all system operators in a district to get personally acquainted face to face, and informal monthly discussions of the daily problems of load dispatching and allied subjects, all have their place in raising the efficiency with which this important kind of work is done.

The preparation of instruction books, anticipating so far as possible the procedure under a great variety of operating conditions, may be extremely helpful. A book of this kind that is used on the Eastern Massachusetts Electric Company system in loose-leaf form is most convenient in making clear the relations of the interconnected plants at Salem, Malden, Revere and Boston. It covers a variety of subjects, including routine handling of lines and stations, transmission-line wiring diagrams, switch and transformer-bank numbering, limits of responsibility for inspection and handling of switches and lines, maintenance routine, inspection schedules, and procedure, in case various combinations of plants are in service, and in the event of emergency

switching situations. This instruction book was prepared by the engineering department of Charles H. Tenney & Company of Boston.

Log-sheet forms providing for the daily plotting of load variations, the hours' run of units and auxiliaries, meter readings in stations and at interchange measuring points, fuel, water and other data commonly found in plant performance records are also used by the Eastern Massachusetts company and are essential to the best results in plant interconnection. Here again the cordial interchange of records and information is vitally important to successful service. Testing routine should be thoroughly settled for regular performance; phasing instructions between systems and between plants, and various practical matters connected with instrument calibrations, all deserve consideration and advance provision.

Necessary and useful instruments associated with interconnection include a master clock, curve-drawing wattmeters, watthour meters, indicating voltmeters, curve-drawing voltmeters, indicating and curve-drawing frequency meters, power factor recording meters (graphic type) and a liberal equipment of synchronizing apparatus. The study of data from these instruments with reference to log sheets and more or less extended information as to weather conditions, water-gage readings and flow records in hydro-electric installations, machine duties, load shifts and transfers, and the preparation of economy charts showing the best methods of handling different systems and plants under varying conditions all contribute to that administration of interconnected plants which saves fuel, labor and expense in their combined handling.

Few are the interconnections in which the first year's operations will disclose the standardization of detail practice attainable after a greater experience. Each recurring annual cycle should bring the precision of control for maximum efficiency in fuel, labor and water utilization closer to the ideal results. Remarkable records have been obtained on some systems where co-operative interchange has had full play. A genuine disposition to share plant resources, plus the efforts of a trained personnel, working harmoniously and with enthusiasm, will deliver a given total of energy to an interconnected system at minimum cost consistent with good service, but the collective profits are difficult to forecast. Substantial gains in net earnings and in quality of service are, however, within the reach of interconnected companies that adopt the plan with full appreciation of its opportunities and responsibilities.

Germany's Experience with Iron Conductors Not Successful

A RECENT issue of the "Annales des Travaux Publiques de Belgique" describes Germany's experience with the use of iron for transmission lines and network extensions during the war. Wires were used for conductors up to 6 mm. in diameter, and cables for conductors of larger size. One source of trouble was the inevitable kinking of the line. The galvanizing was easily damaged, and in making joints and erecting the lines extreme care was found necessary. Moreover, iron proved to be 20 per cent more expensive than copper, though the price per kilogram was only 0.71 mark as against 4 marks for copper. The use of copper is being resumed as quickly as possible.

Readers' Views and Comments

How Water-Power Development Can Add Scenic Effects in Yosemite National Park

To the Editor of the ELECTRICAL WORLD:

SIR: In the Dec. 18 issue of the ELECTRICAL WORLD I have read an article on "Beauty of Use" which takes the stand that the proper development of water powers in the national parks can be made without damage to the scenic beauties of the parks and that therefore this development should be fostered. I am thoroughly in accord with this view and feel that in this connection mention might be made of the proposed development by the Merced Irrigation District of Merced, California. This scheme includes the construction of a dam for storing waters of the Merced River in the Little Yosemite Valley, which is in the Yosemite National Park but farther back in the mountains than the Yosemite Valley proper. The water from this reservoir would be let out during the time of low-stream flow in the Merced River and be brought down through the Yosemite Valley and over the Nevada and Vernal Falls, being ultimately utilized for the generation of power at a point outside and below the boundary of the Yosemite National Park. It would then be turned into irrigation ditches, carried out into the San Joaquin Valley and used for irrigation.

Of course, this means the creation of a lake in the floor of the Little Yosemite Valley. However, it would be at a very high altitude, would be a thing of beauty and would further insure a flow of water over two of the most beautiful falls in the valley, even through the dry season, instead of having them virtually dry at that time as is the case now. Such a scheme, instead of detracting from the beauties of the park, would add to them materially and would lengthen the season of full flow over these falls for at least three or four months of every year.

L. J. MOORE,
Electrical Engineer.

San Joaquin Light & Power Corporation,
Fresno, Cal.

Co-operation Between Central Stations and Isolated Plants

To the Editor of the ELECTRICAL WORLD:

SIR: In the Jan. 1 issue of the ELECTRICAL WORLD the article appearing on page 11, entitled "Co-operation for the Central Station and Isolated Plant," is broad-minded in its viewpoint and gives evidences of the true engineering mind of the writer. The long-standing if mild quarrel between the central station and isolated plant has never been settled on a true economic basis, and in most cases where one supplants the other sound engineering principles have not prevailed.

It is true that central-station service has often brought about a reduction in total costs where the reverse would have been the case had the isolated plant been operated with skill and care, and it is probably safe to say that a great many isolated plants have been shut down that might have been run to the advantage of the owners. As a practical matter, however, the

shutting down of the isolated plant may have resulted in reduced costs, and one could only admit that the end justified the means.

It must be admitted that where steam is used for heating there is a valuable by-product in the form of power which should be made available in those cases where the potential power would justify the expenditure. In most cases there is a very poor balance between energy requirements and heating requirements, and the isolated plant finds itself throwing steam away at certain hours and without sufficient load at other hours. The isolated plant is also more or less complicated when compared with the equipment for satisfactory service when energy is purchased, and these things tend to make its elimination rather attractive to the owners.

Forgetting for the moment that there is a "bone of contention," the article suggests a plan of co-operation that, from the standpoint of fuel economy, is worthy of serious consideration. Consider the case of a large department store or a hotel in which steam is required not only for direct heating but for other purposes, the amount per hour varying greatly throughout the day and with the seasons. If such an institution is developing its own electrical energy, there will be many hours when steam will be exhausted to the atmosphere, which is a direct evidence of a loss of energy. If it buys electric energy, steam will be delivered from the boilers to the places where it is used, with a direct loss of energy. In the latter case, however, there is a great deal to be said in favor of simplicity, of reduced labor costs, of smaller repairs and depreciation and so forth.

Allowing our imagination free rein, suppose that in this institution there was a turbine coupled to a generator which was tied in with the service lines entering from the central-station system, and that the turbine was cut into the steam pipe between the boilers and the heating system. Between the generator and the incoming service is a reverse current switch. When heat is required the valve admitting steam to the turbine would be opened in exactly the same manner as would a valve without a turbine in the line. The turbo-generator set would come up to speed, the automatic switch would close, tying the generator onto the service, and energy would be delivered into the system as a whole. If the amount of steam being used was small, very little energy would be generated. If the valve was opened wider, more energy would be generated and delivered to the system, and at times this would be in excess of the energy required on the immediate premises, in which case it would be pumped into the general reservoir, so to speak. No steam would ever be wasted to the atmosphere, and the current delivered to the system would carry virtually no fuel cost. With the present-day design of turbo-generating units very little attention would be required, and it is quite within the bounds of possibility that this might be given through occasional visits of the central-station force.

If the service is alternating-current, the induction generator would seem to be almost ideal. If the service is direct-current, there would be greater complication in the matter of automatic switching, but the method would by no means be impracticable or unreliable.

Admitting that the central station should receive a higher price for energy sold than it should pay for energy bought, whatever the owner of the isolated plant received would be profit after the fixed charges had been deducted, and these would be small for a simple generating equipment that would be adequate. There have been interchanges of energy with privately owned hydro-electric plants which have worked out satisfactorily, and there would appear to be no serious obstacles where the privately owned plant is steam-driven. The small non-condensing turbo-generator is rather inefficient, but, on the other hand, it is very simple and reliable. Just where the dividing line between practicable and impracticable application of this idea may lie would be hard to predict, but a few applications should provide sufficient data to lay down a general rule.

A central-station management might well reason that it preferred to conduct the business of generating energy in one station rather than in a number, but it seems to the writer that the broad question of fuel conservation may justify a modification of present practice.

WARREN B. LEWIS,
Providence, R. I. Consulting Engineer.

Improving Power Factor by Means of Induction Motors

To the Editor of the ELECTRICAL WORLD:

SIR: I have read with much interest the article of Messrs. Warner and Knowlton which appeared in your issue of Nov. 20, 1920, page 1021, on the subject of improving the power factor of induction motors by supplying constant current to the rotor slip rings. I suggested this method two years ago in the *Revue Générale de l'Electricité* of Jan. 5, 1919, page 505. Subsequently I described a scheme of connections in the issue of June 7, 1919, page 831, and I showed that the direct current could be furnished by a little rectifier or an exciter.

I observe that Messrs. Warner and Knowlton propose to feed direct current to the motors from the central station by means of a fourth wire. May I say that I am not entirely of their opinion on this point? The experiments that I have made have convinced me that for ordinary induction motors direct current at low tension (8 volts or 10 volts at the most) is sufficient, because there is only the ohmic resistance of the windings to overcome. In these conditions I believe that to obtain direct current from the central station would be too expensive and would put too much copper out of use. It would, in my opinion, be better to install in every factory one or more exciters which would supply current to the motors near by.

A. SOULIER,
Paris. Editor *Industrie Electrique.*

To the Editor of the ELECTRICAL WORLD:

SIR: Our experiments with the induction motor were made during January and February, 1919, and the paper was submitted to the ELECTRICAL WORLD in September, 1919, in the face of the recognized possibility of operating an induction motor synchronously. Although discussed mathematically by Steinmetz,* we have not found reports of experimental results. Mr. Soulier's reference to an 8-volt or 10-volt drop through the rotor windings comes very close to the value of 11.4 volts observed with 33.5 amp. through the rotor of our motor. To take this direct-current excitation from, say, a 120-volt source would admittedly involve excessive rheostatic losses. Some factories, however, have low-voltage direct-current supply which could more economically be tapped than to install separate exciter or rectifier.

R. G. WARNER and A. E. KNOWLTON.
Yale University, New Haven, Conn.

*"Theory and Calculations of Electrical Apparatus," McGraw-Hill Book Company, 1917.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Standardized Mountings for Outdoor Switches, Coils and Fuses

TO AVOID having to carry a large number of spare parts and to facilitate changes on outdoor types of disconnecting switches, choke coils and fuses, standard interchangeable mountings have been developed for this type of equipment by the Utah Power & Light Company, Salt Lake City. These mountings for four different kinds of construction are shown respectively by *A*, *B*, *C* and *D* in the accompanying drawings. This design is for the 15,000-volt equipment. The drawings show a combination of fuse and disconnecting switch. Separate units for fuses, switches and choke coils are made in the same form. Locke No. 3 insulators are used, and these are mounted 13½ in. (34.3 cm.) apart. The switches are supported on the insulators by means of a cast-iron cap cemented to the top of the insulator. *A* and *B* show two methods of mounting the insulators on pipes, in the first case running parallel with the line and in the second case across the line. The

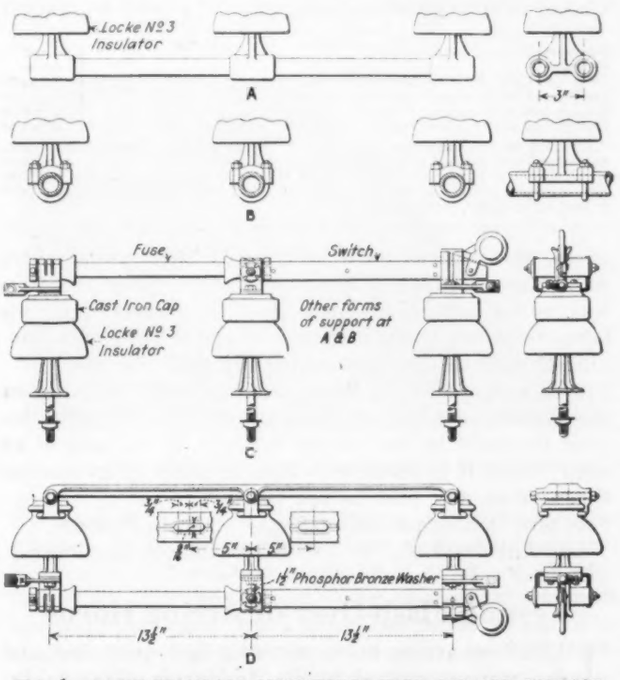


FIG. 1—SAME STANDARD MOUNTINGS USED FOR ALL OUTDOOR 15-KV. SWITCHES, CHOKE COILS AND FUSES

mounting shown in *C* is for bolting to cross-members. A widely used style of mounting is shown in *D*. With this style the equipment is hung below the supporting frame by means of two bolts through the bar, which is clamped on the top of the insulators.

The manner in which the choke coil is mounted on top of the insulator cap is shown in Fig. 2. A supporting block is bolted on to the insulator cap by means of ⅜-in. (9.6-mm.) cap bolts, and the ends of the choke coil are held to this block by means of two ⅜-in. (8-mm.) screws.

This use of standard parts in making up switches and other apparatus means that only one type of insulator need be carried in hand and that similar parts may

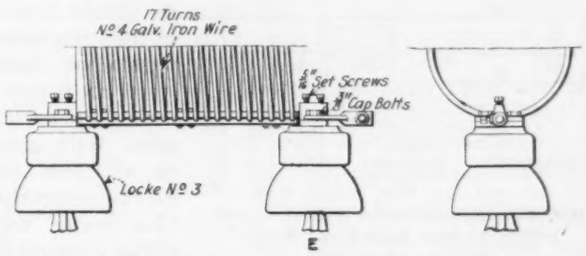


FIG. 2—HOW CHOKE COILS ARE MOUNTED IN STANDARD 15-KV. CONSTRUCTIONS

be carried in stock for whatever equipment is to be mounted. The construction of the supporting frames is simplified by the fact that the span from one insulator to the next is always the same for a certain voltage. As linemen easily become familiar with this standard type of mounting, less time is required for construction work or for making quick replacements in an emergency.

Utah Power & Light Co., Salt Lake City, Utah.
P. P. ASHWORTH, Distribution Engineer.

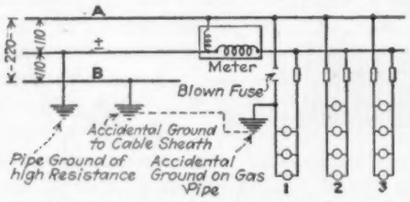
Meter Connected in Neutral Wire Registers Inaccurately

COMBINATION of an accidental ground, a poor permanent ground and incorrect meter connection recently caused a customer's meter to run backward under certain conditions which came to the writer's attention. The trouble was noticed while the meter was being tested using the customer's load. The tester found that the meter ran backward when the lights in a certain part of the house were burning (branch 1 in the diagram), ran forward when the lamps in another part of the house were burning and stood still or ran very slowly if certain combinations of lamps were used. The test of the meter showed that it was registering approximately correctly.

An investigation disclosed that although the lights in the house burned apparently in the normal way one circuit fuse was blown. When replaced this fuse immediately blew again. It was then found that the secondary distributing main was three-wire, 110/220-volt with the middle or neutral wire supposedly grounded. This ground connection was made by driving a ½-in. pipe in the earth and the ground had considerable resistance. The service drop supplying the house in trouble was two-wire and taken from one side of the three-wire bus. The meter had been set improperly with the current coil in the neutral wire.

The circuit having the blown fuse was found to be grounded to a gas pipe on the side which would normally be 110 volts above ground potential. Further investigation disclosed that the remaining phase wire of the distributing main had been accidentally grounded solidly to the lead sheath of an underground service cable, supplying a neighboring residence. This fault brought this phase wire to the ground potential and raised the neutral wire to 110 volts above ground. A 110-volt short circuit was introduced through the regular pipe ground, limited, however, by the high resistance of this ground connection. When the circuit fuse was replaced in the house a 220-volt short circuit took place between the mains through the two accidental grounds.

When lamps connected to circuit 2 or circuit 3 were burned the meter registered correctly, but when lamps on circuit 1 were burned the meter registered backward at approximately the normal rate. With lamps on all three circuits operating the meter ran either forward or backward, depending upon the relative wattage supplied to the circuits.



IMPROPER CONNECTIONS WHICH CAUSED METER TO RUN BACKWARD WHEN GROUND DEVELOPED

The remedy for the trouble was to remove both accidental grounds, to install a better permanent ground connection and to change the meter so that its current coil was in the outside wire of the three-wire system and not in the grounded neutral.

HARRY S. RUSH,
Assistant Professor Mechanical Engineering.
North Dakota Agricultural College.
Fargo, N. D.

Using Conduit as Return Circuit Cuts Cost of Street Lights

BY THE use of the conduit for the return circuit in a street-lighting installation at Beverly Hills, Cal., approximately two-thirds of the cost of a similar installation using two-conductor, lead-covered cable and conduit was saved. The Beverly Hills installation was put in during the war period, and as it was necessary to minimize the cost, the usual method of using galvanized conduit containing two-conductor, lead-covered 500-volt insulated cable and series lamps was too expensive.

The cheapest system that could be installed was No. 8 double-braid, rubber-covered wire installed in conduit. The voltage in such an installation would have to be limited to 600. This was satisfactory, but the layout of the city—wide, curving, irregular streets, broad parkways and large lots—made the use of the standard system of complete loops difficult. There were no distribution poles on the streets, and in part of the city all wires were underground. If complete loops were made around the blocks, the voltage would be too high, and there was always an odd number of blocks. It was decided to light all the lamps until midnight and those on one side of the street after midnight. This simplified the system, reducing it to one wire on each side of the street instead of two, but complete loops could not then be made. The plan of using the conduit for the return circuit then took shape. Tests on a system of forty-one lamps as shown in the table indicated that the method was feasible.

The system at Beverly Hills consists of 375 posts, approximately 300 ft. apart on each side of the street, staggered so that the distance between posts is about 175 ft. Each post holds a 100-cp. 66-amp. series incandescent lamp. More than 21 miles of ½-in. conduit were used in the work. The wire was all ordered on reels so that no joints were necessary between posts. The ends of the conduit were bonded together at the post with punched copper strips, special care being taken that the pipe should be clean and the connection good. The cast-iron posts were also bonded to the conduit.

At the feed points the conduit was carried up the post to within 4 ft. of the arm and equipped with a one-wire condulet. To comply with the state law this conduit was protected with fiber conduit; in some cases as many as three pipes were run through one fiber conduit. At the feed points the one wire was connected to one terminal of the transformer and the other terminal was connected to the conduit by means of a copper grounding strip.

In cases where it was known that extensions would soon be made to the system a length of conduit was installed in the post foundation and faced in the direction of the proposed extension. Several extensions have been made to the ends of the circuits. It is only necessary to disconnect the wire from the conduit, splice it onto the new wire and bond again at the end of the new circuit. Posts have been installed in the circuit between existing posts. To do this the conduit was cut at the point where the new post was to be placed, the wires were disconnected at the adjoining posts, extra wire was connected at these points, and then the wire was pulled out at the new post to connect with the lamp. Conduit bonds were put in at the post, with running threads and lock-nuts, and the post was erected.

TEST OF LIGHTING SYSTEM USING CONDUIT AS RETURN CIRCUIT

Current	6.6 amp.
Frequency	50 cycles
Drop per 1,000 ft. of conduit with complete copper circuit	14.2 volts
Drop per 1,000 ft. using conduit as return circuit	10.0 volts
Energy loss with complete copper circuit (per 1,000 ft.)	32.0 watts
Energy loss with conduit return circuit (per 1,000 ft.)	45.0 watts

Lighting system consisting of forty-one 100-cp., 6.6 amp. series lamps; ½-in. galvanized-iron conduit installed in a loop system from post to post; conductor: one No. 8 B. & S. gage D.B.R.C. wire in the conduit; pipe joints put together with graphite paste; and the ends of the conduit bonded together with copper ground strips in the base of each post.

It is easy to locate the source of trouble arising on the system. In the case of a ground all the lamps beyond the point of the trouble are out; in the case of an open circuit it is possible to find the point by grounding the wire at any post to the conduit.

Southern California Edison Co., N. B. HINSON,
Los Angeles, Cal. Distribution Engineer.

Testing Flash-Over of Arcing Horns

TESTS on arcing horns showing flash-overs wet and dry were described by R. H. Marvin, Thomas Insulator Company, at a recent meeting of the Pittsburgh section of the American Institute of Electrical Engineers. Tests made on seven 10-in. (25-cm.) suspension disk insulators 5⅜ in. (13.6 cm.) apart showed the following flash-over voltages: Without horn, 386 kv.; with bottom horn, 364 kv.; with both top and bottom horn, 308 kv. An interesting feature of the use of two horns is that in this case the wet flash-over voltage was identical with the dry flash-over voltage. The flash-over voltage is about 10 kv. per inch of gap.

New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

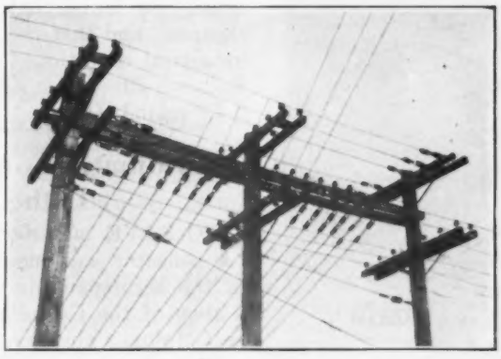
Periodic Attention to Small Turbines Will Prevent Shutdown

THE following advice and instructions regarding turbine operation were given at a recent meeting of the operating engineers from different steam generating stations of an Iowa central-station company. It is of prime importance to watch the circulating water at all times. See that the oil temperatures are about the same from day to day. If a wide variation in oil temperature is noticeable, determine whether the cooling coils are clean and free from mud and look for a slimy substance on the inside of the oil tube. Partly obstructed turbine blading can also cause the oil to run hotter than normal. The blading may accumulate scale, and sometimes a gummy substance consisting of a mixture of oil and mud will stop the flow of steam through the blading and build up a back pressure on the dummies. The resulting end thrust may cause very rapid heating. To remove this substance pump coal oil through the first stage of the machine until the oil comes out clear and free of dirt. This procedure should be carried out about once a month if much trouble of the nature indicated is experienced.

The feed water used in most of this company's plants causes more or less trouble from scale and mud. The trouble seems to be the worst where the boilers have to be forced at high rating in order to hold steam. Forcing the boilers has a tendency to lift the water in them and carry more or less mud with the steam into the turbine. The valves and governor should be watched to see that they do not stick. The sticking may make the machine slow down or overspeed and trip out, thereby causing a shutdown or damage. This trouble, like many others, can and should be eliminated by proper attention to maintenance work.

About 50 per cent of the cases of trouble in most small power plants are due to carelessness on the part of the man in charge. He should not let his work pile up so that when he does start to put his station in shape he will be kept too busy to see other troubles just starting and remedy them before something breaks down. If a man leaves one repair job half finished to go and fix something else which he considers of more importance, he may never get anything finished, whereas if he had worked on each case as soon as the first symptom appeared he would not have had the breakdowns as the trouble would have been remedied before it had time to develop into a serious stage.

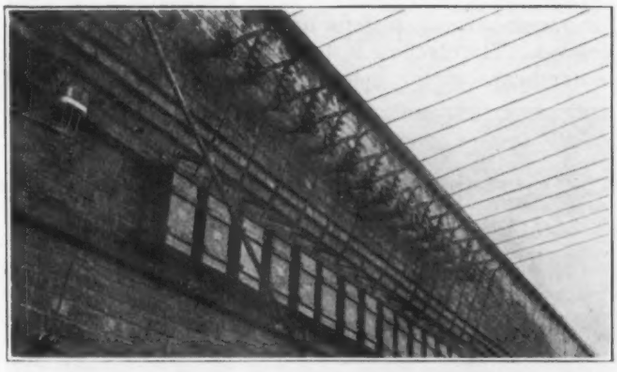
Iowa Railway & Light Company, Marshalltown, Iowa: JOHN M. MAY, Traveling Engineer.

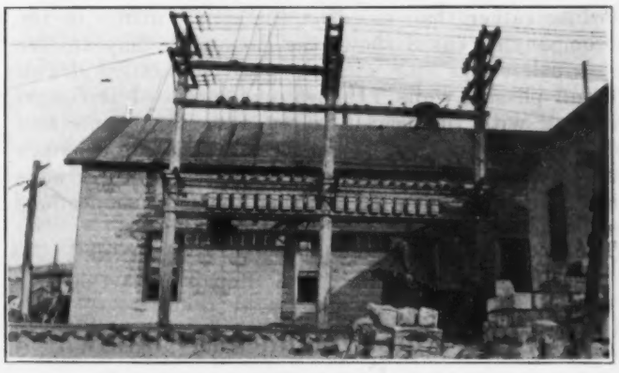


Economical Construction for Outgoing Lines

AN ECONOMICAL construction for supporting outgoing and incoming lines at a station where the expense of steel towers is not warranted is shown in the accompanying photographs. One type of structure of this nature has already been described by the writer in the ELECTRICAL WORLD (Jan. 15, 1921, page 151). In the present case the poles are set close to the building, as shown in *C*, with the cross-arms overhanging. The incoming circuits are dead-ended on the top of the poles, and from this location they pass down on insulators supported by cross-bars to the lightning arresters, which are also supported on a cross-bar lower down on the pole. From here they pass through porcelain insulators into the building.

At *A* is shown a distribution structure about 100 ft. (30 m.) away from the substation built to accommodate six circuits. *B* shows the line entering the substation. The incoming circuits are dead-ended on the cross-pieces at the poles and on suspension insulators fastened directly to the brick wall of the building. In this case the lightning arresters are mounted on wood pieces bolted on the wall. Mounting these lightning arresters outside the station effects considerable economy as regards labor cost and saving of space where the apparatus is liable to be crowded if installed inside the building. In a layout for incoming and outgoing feeders ample provision should be made for taking care of future additional circuits. There should be flexibility so that connections may be made from one circuit to any other and so that circuits may be paralleled.





ECONOMICAL CONSTRUCTION FOR SUPPORTING INCOMING LINES

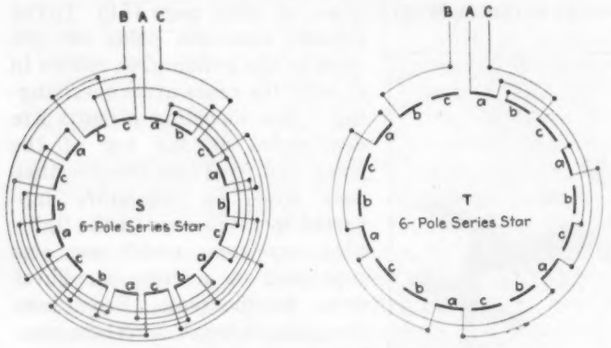
Lykens, Pa. A. L. JOHNSTON, Electrical Construction Engineer.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Simplified Diagrams of Motor Connections

IN MAKING drawings showing pole connections of induction motors it will usually add to the clearness of the diagrams if only the connections of one phase are shown. As each phase may be connected exactly like the others, the filling in of all the connections tends to



TWO METHODS OF DRAWING THE SAME DIAGRAM
T shows only one phase connected, while *S* shows full diagram.

confuse rather than to assist the repair man. In the accompanying cut *S* shows the customary diagram for a six-pole series star winding with connections drawn for all phases, while *T* shows one phase of the same winding with the lead-in wires and star connections of the other phases. The second diagram is much easier to follow. In using such a diagram all the groups in *A* phase are connected and then the same connections are made on *B* phase and *C* phase successively.

The Brown Company, RALPH MCKINNEY,
East Berlin, N. H. Repair Department.

Cost of a Motor Includes Breakdown Expenses

THE correct way to judge the cost of a motor is to consider its total cost during its useful life, from purchase to scrap heap, estimating probable cost of repairs, lost time and other factors as closely as possible, in the light of past experience.

A breakdown means more than the simple cost of repairs. The cost of taking out the broken-down part of the machine and replacing it must be considered, also the loss of production during the change. Compared to these the cost of repairs themselves is often insignificant, and recognition of the fundamental law that the cheapest machine in the long run is seldom the one which is the lowest in first cost is compelled. For instance, a motor which costs $1,000 new, and which is skimped in some respect, might easily cost another thousand dollars each year for repairs, all told, while a better built machine of perhaps 10 per cent greater first cost, working under the same conditions, might require only a small fraction of its original cost in annual repairs.

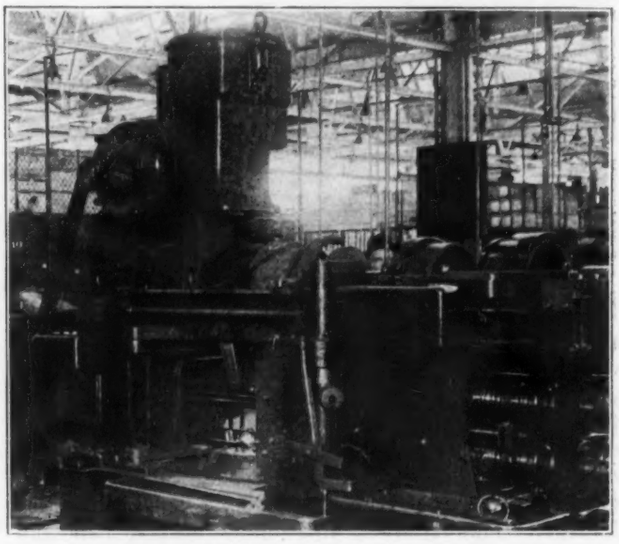
This principle is true of small things as well as large, for example, a lathe tool. Its first cost is not great, and during its life several times its first cost is expended on it in dressing and grinding. For a little greater first cost a tool of high-speed steel can be bought which will do several times the amount of work without redressing. There is no doubt which tool is the cheaper in the long run. When all the points have been duly weighed, it will usually be found that the best obtainable is really the cheapest, and that the best is none too good for modern industrial conditions. JAMES DIXON.

Reliance Electric & Engineering Company,
Cleveland, Ohio.

Automatic Compensator Mounted on Lathe to Save Room

TO SAVE manufacturing space the automatic compensator was mounted directly on the lathe shown in the accompanying photograph, which was taken in a shop of the Canadian Products Division of the General Motors Company.

This photograph shows a Cone automatic lathe used for rough-turning pistons and cutting the piston-ring grooves. The machine is driven by a 15-hp., 1,500-r.p.m., squirrel-cake motor belted to the lathe and equipped



COMPENSATOR DOES NOT OCCUPY ANY WORKING SPACE

with a belt tightened on the side farthest from view. Stopping and starting is effected by means of push-buttons which operate the automatic compensator shown to the right of the motor. ALEX. H. MAY,
Works Engineer.

Canadian Products Division of General Motors Co.,
Walkerville, Ontario.

Selecting Electric Locomotives for Metal Mines

IN MANY cases the selection of a locomotive for use in a mine is rather a simple matter, more especially when the tonnage is small and the distance short. In some of the larger copper mines, however, trains of 500 to 600 gross tons are handled and the ton-miles will often be approximately 200,000 per month. Under these conditions the selection of haulage equipment is not such a simple matter. The tunnels are usually sufficiently high to maintain the trolley above the height of a man's head. On the other hand, they are usually more narrow than in coal-mine practice. Track gages run from 18 in. to 36 in. as a rule. This calls for a higher and narrower type of equipment.

Equipment is naturally limited to manufacturers' standards with limited special features. The types offered are mainly rugged machines well adapted to the abuse and severe operating conditions which they are bound to receive. If the conditions of operation are carefully considered, the duty calculated, and the conditions of accessibility for repairs, liberal size of wearing parts, motor capacity and lubrication are studied, very satisfactory results can be attained. The selection of a locomotive for particular requirements is largely dependent on conditions not under the control of the electrical department, and a locomotive must be selected to meet these conditions. In all cases future requirements should be considered.

Battery Locomotive Gaining Favor in Metal Mines

The trolley and the storage-battery types are the only types which have found much favor in metal mines. The selection of the particular type is largely a matter of judgment. The trolley locomotive is probably the most popular, although it is rapidly being replaced by the storage-battery type on the lighter hauls. For heavy, long, main-line transportation the trolley locomotive apparently offers the cheapest over-all cost of all of the means of locomotion. It can also be used to advantage on such branch lines as offer sufficient tonnage or permanency to warrant the installation of trolley wire and bonding. The storage-battery type is very useful in cases where the tonnage is small, the distance short, and for following up development work, even though a trolley may be installed in the new drifts when completed.

Standardization on a few types and sizes will frequently result in savings from interchangeability and will expedite repairs. In this double or triple heading of similar units for increased draw-bar pull will give a considerable range while retaining interchangeability of parts. A compromise between standardization and exact size will often be found to bring the most satisfactory results when the haulage conditions vary considerably on one property.

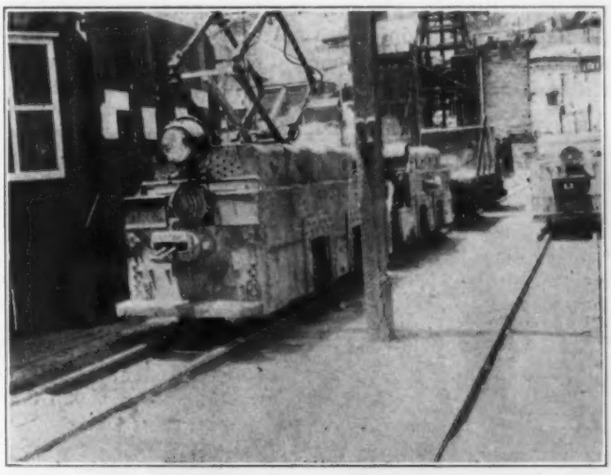
For light, short hauls the problem does not require a full investigation of all the details, but for important installations the general factors should each be considered in detail. The primary factors to be considered are tonnage distance, time, grades, car friction and car capacity. The secondary factors are curves, track weight, track condition, wind resistance and tunnel clearance. For any given problem some one or more of the secondary factors may become a primary or even a determining factor. Tonnage, distance and time in most cases will be the conditions around which the haulage systems will be designed. The grades encountered usually cannot be remedied in old work but should be carefully considered in planning new haulage ways. The gradient of equal traction can be calculated and will result in a minimum power consumption. The motors will heat more, however, as the current will be the same for both loaded and empty trains. Car friction and car capacity are inherent in the design of the cars and should be made as favorable as possible. In general, the largest cars available will give the lowest costs, other things being equal.

Curves in mining work are ordinarily short and of small radius, but when possible a minimum radius of 50 ft. should be adopted. Where curves are frequent and close together their effect on train resistance may be serious. Under ordinary conditions with well-laid-out curves the resistance will be a negligible factor. Track weight and condition will tend to increase the rolling friction, but the most serious effect is on maintenance costs. On main haulages a heavy rail on a well-ballasted roadbed will rapidly repay the difference in first cost in lowered upkeep costs of cars, locomotives and track. It is almost impossible to keep track smaller than 25 lb.

EFFECT OF CAR-SIZE ON ENERGY CONSUMPTION FOR A TYPICAL HAULAGE PROBLEM

250 tons to be hauled an average distance of 1,600 ft. Storage-battery locomotives to be used. Average speed, 4 miles per hour. Tunnel size limits the car capacity to 3½ tons. Grades level. Loading from chutes. Cars available, 1 ton and 3½ tons.

	1-Ton Cars	3½-Ton Car
Total cars hauled	250	72
Cars per train	20	7
Loading time per train, minutes	15	7
Running time per round trip, minutes	10	10
Dumping time per train, minutes	10	7
Total time per round trip, minutes	35	24
Number trips required	13	11
Actual working time for 250 tons	7 hr. 25 min.	4 hr., 24 min.
Car friction, lb. per ton	30	20
Weight per car empty, lb	1,500	5,000
Weight of empty train, lb	30,000	35,000
Weight of ore in loaded train, lb	40,000	49,000
Weight of loaded train, lb	70,000	84,000
Weight of locomotive, lb	6,000	6,000
Total weight of loaded train, lb	76,000	90,000
Necessary draw-bar pull for loaded train, lb	1,040	900
Coefficient of adhesion, per cent	25	25
Draw-bar pull of locomotive, lb	1,500	1,500
Maximum kilowatt input at motors	15.1	11.9
Kw.-hr. per day consumed by motors	33.2	22.8
Kw.-hr. delivered to motor-generator per day	83	47
Power cost per shift, at 3 cents per kw.-hr.	$2.49	$1.41
Ton miles per shift	75	75
Kw.-hr. per ton-mile	1.1	0.63



PANTAGRAPH-TYPE LOCOMOTIVE USED BY ARIZONA COPPER COMPANY FOR MAIN HAULAGE

in proper alignment with frequent motor traffic. Wind resistance in the ordinary haulage at low speeds will be a negligible figure, but with the advent of mechanical ventilation systems using the main haulage ways as air ducts it may call for serious consideration. The ordinary formula for wind resistance on moving trains in the open will probably not give correct results, as the action will more nearly correspond to a piston effect, with the main pressure on the first car and a decreasing effect toward the back of the train. Tunnel clearance will determine the limiting size of the locomotives and cars.

As an example of the influence of some of these points the example given in the table will be of interest. It is evident that in this case the tonnage is too great to handle with the 1-ton cars, while it could be very readily handled with the 3½-ton cars. The power consumption will also be less with the larger cars. This is due to

SEVERE SERVICE REQUIREMENTS MUST BE MET BY MINE-TYPE ELECTRIC LOCOMOTIVES

the ratio of total load to the weight of the empty car, to the difference in the car friction and to the increased number of trips. These differences are more marked as the car size is increased, but this example was introduced to show that even on a small tonnage it is well to examine the conditions. The labor cost is about uniform per train; thus the operating labor per ton mile varies inversely with the tonnage per train.

The most widely used voltage is 250 volts, direct-current, although voltages as low as 125 and as high as 600 have been used. The 250-volt lines will cover a large territory with reasonably small feeders if the drop is proportioned somewhat in accordance with traction practice. The load is very intermittent, and it will usually be economically impossible to provide enough copper to keep the drop less than 20 per cent at times of peak load. This does not interfere with starting a heavy train and gives fair regulation at lighter loads. The matter of safety is largely dependent on the care used in the installation of the trolley wire and in the methods used in the protection of the circuits. Where the miners are used to handle the trolley installation they become careless and will not take sufficient precautions to avoid accident. Where the electrical forces make all changes in the wiring the other departments gain a respect for the wires which has a good effect in reducing the accidents from accidental contact. The cost of installing underground trolley with present material and labor costs should not exceed 40 per cent per foot of drift. The cost of bonding is largely dependent on the type and size of bonds used, but should not exceed 10 cents per foot of drift with any of the bonds commonly used in this class of work. While the total of 50 per cent per foot of drift may appear somewhat high, it calls for a very high grade of work upon which the maintenance cost is very low. Where this grade of work is done the trolley maintenance is usually such a small item that it is not separately calculated in the cost accounting. Maintenance work cannot be entirely eliminated as the greater portion is caused by alterations in tracks, timbers or source of ore supply, or by accidents due to falling rock or to broken timbers. These are beyond the control of the electrical department. In general, the better class of material will, if properly selected, give the greater salvage when the drift is abandoned.

GOOD BRAKES ESSENTIAL TO SAFE OPERATION

Proper brakes are essential to expeditious handling of trains. For small units and light trains, on fairly level track, hand brakes will usually suffice. When the locomotive weight required exceeds 8 tons or 10 tons or when excessive grades are encountered little is gained by depending on hand brakes. Under ground a brakeman cannot handle more than two cars, and these must be placed in proper position in the train. The locomotive brakes are slow to apply and release. The general tendency is to run with the brakes dragging, which tends to heavy repairs of brake shoes and wheels and also heats the motors. A straight air system on the locomotive will prove an economy in operation and will tend to increase the amount of work done per locomotive. In the case of heavy trains, 300 tons or more gross, it is well to use automatic air with air brakes on at least a portion of the cars. For medium grades it is not necessary to equip all of the cars with air brakes. A few can be so equipped and the rest furnished with train lines and hose connection only. In such cases it is well to distribute the cars equipped with brakes throughout the train rather than allow them to be bunched together.

A number of different types of collectors have been used in mining work with varying degrees of success. The trolley pole and wheel trolley are quite generally used and are the only practicable type where the trolley wire is placed at the side of the drift or where it is necessary to trough the wire. They have the disadvantage that somewhat greater care is necessary in the alignment of the wire and in the setting of frogs. The pole must also be turned when the motion is reversed. Under conditions where the wire is in the center of the track and overhead clearance will permit the pantagraph with a sliding collector will give better results. A longer life can be obtained for the wire, as the sparking and burning are virtually eliminated. The pantagraph is reversible, and no trouble is encountered from wheel flats, bearing or harp wear or from un-

balanced wheels. The wear plates are cheap, have a long life and are readily renewed when worn.

Oil and waste lubrication have given the best results on axle bearings and are quite generally used on armature bearings. Some of the newer types are offered with ball bearings for the armature shafts and have proved quite satisfactory. Many of the older types, designed for grease lubrication, can readily be converted to oil and waste lubrication with a considerably increased life of bearings. Gears should be inclosed and run in oil, or a suitable pinion grease should be applied in sufficient quantity to allow the lower portion of the gear to pick it up and carry it to the intermediate gears or pinion.

The frame should be of sturdy construction, motors of ample size to accomplish the desired work without undue heating, and the control equipment simple with current-carrying parts of ample size.

El Paso, Tex. T. H. ARNOLD,
Formerly Electrical Engineer Arizona Copper Company.

Factors to Investigate Before Installing Motor Drives

BEFORE installing motors in industrial plants a complete analysis of conditions is called for. The application of electrical drive involves the proper combination of motor, controller and driven machinery. Therefore the characteristics of all three elements must be studied, together with the other features of each installation. A number of questions which must be answered before the type of equipment can be determined are given in the following list suggested by L. H. Adams, General Electric Company, at a meeting of the Engineering Society of Western Massachusetts:

CONDITIONS DETERMINING KIND OF MOTOR AND CONTROL EQUIPMENT NEEDED

1. Alternating or direct current available?

2. Voltage and frequency (if alternating current)? Possible variations in same?

3. Capacity of generating station and lines? Other load on systems? (This information is required for determining effect of starting.)

4. Description of machine to be driven? Continuous or intermittent service? Can intermittently operated machines be arranged to operate not simultaneously? Limited speed?

5. Method of Drive.—Group or individual? Direct connection? (Size of coupling, rigid or flexible, insulated? Shaft extension, sub-base, etc.?)

Belt Drive.—Size of pulley, distance between pulleys, outboard bearing, belt tightener?

Chain Drive.—Size of pinion?

Gear Drive.—Size of pinion?

Friction Drive.—Is motor to be started light and clutch thrown in when motor is up to speed?

6. Load Conditions.—Continuous? Cycle duty, in which a definite cycle repeats itself with more or less regularity, the machine stopping between each cycle? Varying-load duty, in which more or less definite cycles are repeated but motor runs continuously? Load diagram required during a complete cycle of operation. (This gives maximum horsepower, length of time load is on, time off and friction load.) Can any parts of cycles be varied with benefit? Variation in load caused by change of conditions, such as decrease in the head on a centrifugal pump. Allowance must be made in the motor size to take care of such contingencies.

Future Conditions.—Is it possible that the load on the motor may soon be increased? Motor speeded up? Flywheel effect required?

7. Starting Conditions.—Frequent starting, stopping or reversing? Number and time off? Time of acceleration? Does load on motor increase as it comes up to speed?

8. Speed.—Is close speed regulation essential? Constant speed? Adjustable speed? Multi-speed? Speed range required? At reduced speed is horsepower output reduced in proportion to speed (*i.e.*, constant torque)? If not, give the proportion.

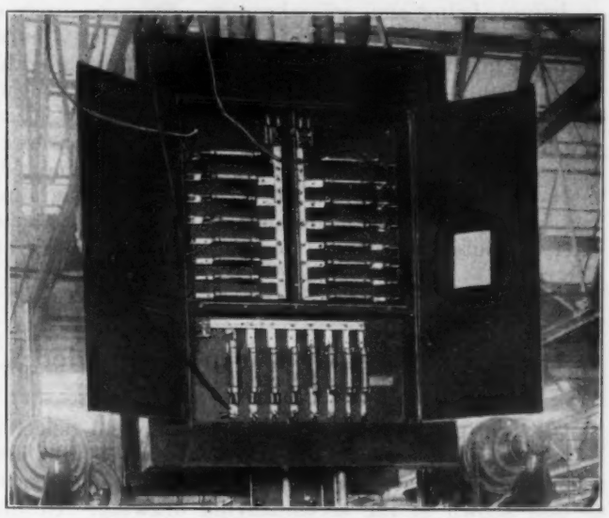
9. Control.—Hand or automatic? Remote? Overload or under-voltage release? (Time setting?) Limit switches? Brakes (mechanical or electrical)? Stopping of large motors?

10. Conditions of Location.—Dust, moisture, acid fumes, inflammable material, high temperature, etc.? Ventilation? Space conditions (method of mounting motor, access for repairs, etc.)? Safety arrangements? Insurance rules?

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD

Compact Panel Box for Three-Phase Branch Circuits

A DISTRIBUTION panel only three-fourths the size of ordinary three-phase panelboards is employed on the 550-volt power circuits in the shops of the Canadian Products Division of the General Motors Company, Walkerville, Ont., Canada. The panel is divided into three parts, as shown in the photograph, with barriers separating the parts. In each section are fuses connected to only one phase of the three-phase



THIS ARRANGEMENT OF FUSES AND BUSES SAVES 25 PER CENT OF PANEL SPACE

lines. The arrangement permits the length of the cabinet to be reduced by 25 per cent while maintaining the same width as the regular standard panel. The cost is therefore less than that of the standard panel. Moreover, the fuses may be removed with greater safety, as all adjacent live parts are of the same phase. This eight-circuit panel is arranged so that three circuits can be fused up to 100 amp. and five circuits up to 60 amp. To change the rating of a circuit all that is necessary is to remove two screws and change the fuse clips. By special permission the bottom of these panels has been mounted 6 ft. (1.8 m.) from the floor, as shown, so that they do not take up any of the manufacturing floor space. Small stepladders kept at convenient points around the plant are used to reach the panels when necessary. L. A. BLACKBURN,
Operative Engineering Division.
Dupont Engineering Company,
Detroit, Mich.

Proper Care of Electrically Heated Oil-Tempering Baths

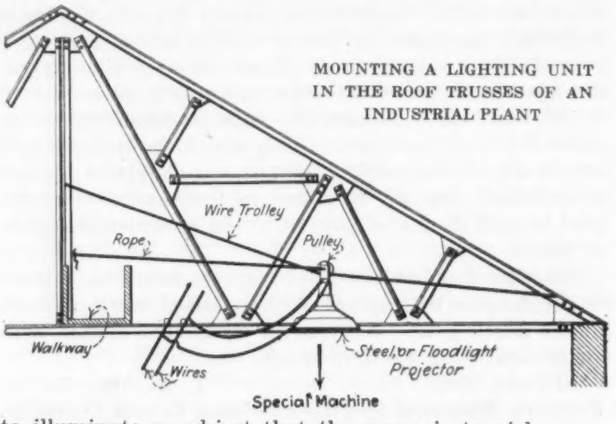
FIVE electrically heated oil-tempering baths are in service at the factory of Pratt & Whitney, Hartford, Conn., and experience has developed the following maintenance routine: The tanks are about 24 in. x 24 in. x 14 in. and will hold about 600 lb. of steel. They have six 220-volt heating elements each. At first some trouble was experienced in keeping the electrodes clean and in washing the oil off the work treated. Every five or six weeks the oil is all taken out of the bath after standing over Sunday or for a similar length of time. The oil is allowed to settle so that the charred oil will fall to the bottom of the bath, whence it is removed as carefully as possible to avoid churning. The carbon sediment can be removed with the loss of only an inch or so of oil. The oil can be strained and used over again if necessary, tending to prolong the life of the heating units.

Every three or four months the electrodes are cleaned from carbon deposits. This is done by removing the heat units, taking out the oil and wiping the tank clean. The heat units are then put back into the empty bath. The switch is closed, the bath being watched, and as soon as the electrodes become red hot the switch is opened and they are allowed to stand. After a minute or so, if the oil does not flash, current is again applied as before, being shut off when the electrodes become red. Should the oil flash, it is customary to let it burn until the fire dies out. Then current is turned on again until the units are red hot to dry up the residual carbon sediment and moisture. After this, the current is again cut off and the bath is allowed to stand until the electrodes can be handled. These are then disconnected, the panel is removed from the bath, and all remaining dirt left on the units is brushed or blown off. About thirty minutes is required for the proper cleaning of electrodes.

C. T. HATHAWAY,
Pratt & Whitney, Hartford, Conn. Electrical Dept.

Local Lighting by Lamp Suspended on Pulley

FOR lighting an area over which a lamp and reflector cannot be mounted in the usual way some mills use a lamp suspended on a rope by means of a pulley, such as that shown in the accompanying drawing. In the case illustrated the lamp could not be mounted below the trusses on account of coming in the way of a traveling crane. Consequently, a pulley was attached to the unit and the entire outfit was hung on a wire trolley rope fastened to the roof girder and to the center girder of the building. The unit is allowed to run out by gravity to the best location for illuminating the work on the floor, and it is held in this position by means of a rope. When it is desired to clean the unit it is pulled up to the walkway shown, where it can be handled without any trouble. Connection is made to the branch feeder by means of two flexible leads. In place of the R. L. M. dome reflector, one plant employs floodlight projectors for concentrating the light. Standard "Mazda C" lamps are used, since the concentrated filaments of the floodlight lamps are unsuited to burning with the tip downward. The development of an extension metal sleeve applicable to small floodlight projectors now enables these units to accommodate the standard large "Mazda C" lamps, and while these do not give so close a concentration, they may be used in any position and therefore have a wider field of application in factory and mill lighting. In addition to the applications mentioned, such a floodlight unit when mounted on a crane where it can be adjusted by the operator may be used



MOUNTING A LIGHTING UNIT IN THE ROOF TRUSSES OF AN INDUSTRIAL PLANT

to illuminate an object that the crane is to pick up or to spot the place where a heavy casting is to be deposited. Such a unit forms an excellent supplement to general overhead lighting.

SAMUEL G. HIBBEN,
Consulting Illuminating Engineer.
Westinghouse Lamp Company,
Bloomfield, N. J.

Vibration from Two Air Compressors Eliminated by Balancing

EXCESSIVE vibration of a substation in a New Jersey shipyard caused by two air compressors was eliminated by balancing the vibrations of one against those of the other. These compressors were driven by synchronous motors, and the balancing was accomplished by making them run so that the piston in one pump was at all times moving in the opposite direction from that in the other.

Although vibration may be caused by compressors operating in substantial buildings, it was especially annoying in the case mentioned on account of the fact that the building was supported on 40-ft. piles driven in filled-in land. It was necessary to fill in this swampy land to provide space for ways, shops and storage owing to the rapid increase in production facilities needed in this yard during the war. The building was a substation containing two 250-kw. rotary converters and two direct-connected air compressors, driven at 180 r.p.m. by two 450-hp. synchronous motors. The vibration caused by the operation of these compressors was so great that the entire building and the surrounding ground vibrated noticeably. Various remedies were suggested, but none of these seemed to be practicable. The shutting down of the substation was under consideration until the engineer in charge decided to balance the stroke of one machine against that of the other.

To carry out this plan an electrical contact was placed on the shaft of each compressor, and the two were connected in series with a bell so that the bell would ring when the respective pistons were moving in opposite directions. One machine was started and thrown on the line and then the other was phased in when the bell rang. Once the machines were started in opposition, they remained in this relation as the synchronous motors kept in step. This balanced the two compressors against each other and the vibration was totally eliminated.

West Collingswood, N. J. L. C. BEATY.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

National Good Will for Electric Utilities the Aim of the N. E. L. A.

NATIONAL good will for the electric light and power utilities has been the goal of the major new activity of the National Electric Light Association during the current administration. A comprehensive program for bringing this about has been built up and as rapidly as possible is being put into operation. This naturally takes the form of a national publicity campaign which has a number of tie-ins.

Member companies have given their hearty support to the campaign and have sent out millions of pieces of literature prepared by the association publicity department. The interest of investment bankers, public utility commissioners, insurance men and others has been secured. The Investment Bankers' Association of America has adopted resolutions favorable to public utilities as a direct result of the activities of the association. The National Association of Railway and Utilities Commissioners has been advised of the activities of the association and the members have expressed their belief in and approval of those activities. Articles have been printed by popular magazines and other and similar articles will be forthcoming.

6,600,000 Kilo Watt Pamphlets

"Kilo Watt" pamphlets to the total number of more than 6,600,000 have been ordered and are being sent out by member companies to their customers. These pamphlets were prepared with a view to interesting users of electricity in some of the problems of the electric light and power industry, the first series being devoted to preparing an approach, and the second series which is to follow being designed to deal with the most important questions now before the electric light and power companies, such as taxation, regulation, finance, etc. Approximately four hundred thousand "Facts Every User of Electricity Should Know" and two hundred thousand "Everyday Electrical Terms and Usage" pamphlets also have been ordered and are being distributed by member companies. A series of investment pamphlets was prepared and two hundred and fifty thousand of these have been ordered.

The preparation and sending out of pamphlets has been but a small part of the publicity program. The publicity department of the N. E. L. A. has taken the lead in the organization of state committees on public utility information throughout the country. Eleven states already have been organized with committees or bureaus composed of representatives of all classes of public utilities, and having for their purpose the dissemination of facts and figures regarding public utility development, and present-day and future problems of the utilities. The organization of similar committees is practically assured in nine additional states, utility men in several other states evincing considerable interest.

Realizing that the development of the entire electrical industry depends primarily upon the prosperity and development of the electric light and power industry, the N. E. L. A. has been working toward a co-operative campaign in which manufacturers of electrical machinery, equipment and supplies would publish with paid advertisements in popular magazines, newspapers and trade journals, supplementing a direct advertising campaign by the association. The association's own direct advertising campaign will begin Feb. 19 with a half-page advertisement in the *Saturday Evening Post*. Twelve similar advertisements will appear in subsequent issues of the *Saturday Evening Post*. Considerable electric light and power company goodwill advertising already has appeared over the names of the G. & W. Electric Specialty Company, the Western Electric Company, the Electric Storage Battery Company, the Jeffery-Dewitt Insulator Company and the Anaconda Copper Mining Company. Many light companies have asked for proofs of these advertisements, to be posted about their plants and to be utilized in various other advertising ways.

M. H. AYLESWORTH
Executive Manager N.E.L.A.

Reprints for Local Advertising

In connection with the association's direct advertising it is arranging to have the advertisements printed on posters twice the size of the original advertisement, and these posters will be sent to all member companies for use in their windows on billboards and elsewhere. Also, these advertisements are being reproduced in matrix form for paid advertisements in newspapers, the advertisements to be two columns wide and 10½ in. deep. These advertisements will be placed and paid for by the local electric light and power companies whenever used.

In addition to the above, member companies are being urged to inaugurate and carry on continuous advertising campaigns in their local newspapers as a part of the program to educate the public to the fact that the progress and prosperity of the electric light and power industry are absolutely necessary to the continued progress and prosperity of any community and of the country as a whole.

There are other phases of N. E. L. A. work which are of comparatively recent origin and which are of considerable importance. In addition to the very extensive

committee work which has been carried on throughout the years of the association's existence, the program includes specialization in engineering through the engineering department, which is directly under the Technical Section, and the work of which includes such important matters as inductive interference, safety rules, standardization, etc.; specialization in accounting and in furnishing statistics and detailed information through the service department, which co-operates with the Accounting Section, and the work of which includes the preparation of a uniform classification of accounts, and assistance to the Federal Power Commission in the preparation of an accounting system. Rate research and the rate book have been brought to national headquarters, and, under the direction of the standing committee on rate research, improvements are being made and an active campaign for increased circulation and more general usefulness is now being conducted. The N. E. L. A. is taking a more active interest and part in the work of the American standardization committee, and there are many similar activities being conducted through the departments.

Facing a period of temporary depression, the Commercial Section is bending every effort to stimulate commercializing of electrical energy and appliances and predicts a return to normal in this branch of the electrical industry in the very near future.

Division of the country into geographic sections naturally means the intensive development of the work of the N. E. L. A. in each of these divisions. Instead of the work being centralized at national headquarters it is to be carried on simultaneously throughout the country in the twelve divisions, and, so far as applicable to conditions there, also will be carried on in Canada simultaneously.

A department of lighting recently has been established, and the industrial lighting exhibit will be demonstrated in many of the principal cities of the country. Demonstrations already have been held during the last few months and an itinerary has been skeletonized and is being completed rapidly.

As a result of the increased activities of the association during the year, 110 new electric light and power companies have been added as class A members and there have been no resignations.

Indiana Rules Governing Rural Electric Service

THE rules and standards of electric service for electric utilities issued by the Public Service Commission of Indiana, under Rule 32, provide the following requirements governing rural service:

EXTENSION OF LINES FOR RURAL SERVICE

(a) *Definition.*—A rural consumer is one whose premises are without the corporate limits of a municipality and one requiring an investment per consumer's unit demand greater than is ordinarily required for consumers within municipalities.

(b) *Cost of Service.*—Rural consumers may have electric service, provided they will compensate the utility for the fixed and operating costs of the service.

(c) *Rates.*—Rates must not be discriminatory, and because greater investment is required per rural consumer's unit demand and greater line loss is suffered in rural distribution than with municipal consumers the rate should be higher for rural service than for service in the utility municipal area. All consumers must bear their fair share of the utility's expenses, some of which may be enumerated as follows: Interest on investment, depreciation, taxes, insurance, general office and officers' expenses, operating labor and supplies, maintenance, coal, meter reading, accounting and collecting, etc.

(d) *Form of Rate.*—The rate shall consist of two parts: (1) A "minimum bill" partly to cover the fixed charges; (2) an "energy charge" to cover the operating costs of generating, transmitting and distributing the electric current.

(e) *New Consumer.*—A new consumer proposing to take service from an extension paid for by a group of consumers shall share in the cost of the extension.

(f) *Guarantee.*—The utility may require of the prospective consumer a satisfactory guarantee that he will fulfill all the obligations made by him to the utility.

(g) *Safety.*—Safety in construction and maintenance is essential. Divided ownership and responsibility are not good public policy, and the construction of electric lines by inexperienced persons or companies is discouraged.

(h) *Acquisition of Lines.*—To the end that safety and uniformity may be obtained in the rehabilitation and maintenance of electric lines the utility may acquire lines owned and constructed by others.

Duties of Commonwealth Edison New Industrial Relations Department

THERE has recently been established in the organization of the Commonwealth Edison Company an industrial relations department, which is specially charged with the promotion of the well-being of the employees of the company and harmonious relations between the employees and the management. This department is headed by a manager of industrial relations, who reports directly to the president, except upon special occasions, when upon the written direction of the president, to be given on each occasion, he will report to an executive council made up of the vice-presidents.

One of the general duties of the manager of industrial relations and his department is to supervise in an impartial manner, as between the management and the employees, the development, introduction and operation of an employees' representation plan.

The manager of industrial relations has the administrative responsibility for developing and carrying out a comprehensive personnel and employment policy in the company service and for the management of the units of the company organization performing functions of personnel administration. He is also responsible for co-ordinating the work of these units of organization and the personnel activities of company committees and employees' associations. The functions of the management concerning the employees which have been delegated to and centralized in the industrial relations department are (1) employment, (2) health, (3) safety, (4) education, (5) welfare, (6) employee-management relations.

The position of dean of women in the department of industrial relations has also been created. The dean of women is charged especially with the duty of promoting the well-being and the representation of the women employees. She reports to the manager of industrial relations on all matters, but is free to take up directly with the president any matter relating to women employees or women applicants for positions. A separate office for the dean of women is maintained in the industrial relations department, and any woman employee or applicant has free access to the dean of women for confidential interviews.

The following heads of departments report to the manager of industrial relations: Superintendent

employment bureau; chief surgeon, in charge of the medical department; inspector of safety and fire prevention, in charge of the safety bureau; supervisor of lunch rooms and recreation rooms, and superintendent accident liability department, in reference to all matters of employees' compensation.

The company's co-operation with the Commonwealth Edison Mutual Benefit Association is under the direction of the manager of industrial relations, and the administrative force of the association provided by the company reports to the manager of industrial relations. The services of the Central Station Institute in connection with the education and training of the employees of the company will be under the general direction of the manager of industrial relations.

The manager of industrial relations co-operates with the following committees and their respective subcommittees which deal with personnel matters: The budget and expense committee, the advisory committee, the employees' savings fund committee and the service annuity committee. He also co-operates with the Edison Club in reference to all its activities, including the Electra, the Edison symphony orchestra and the publication of the *Round Table*.

Thrift Pamphlet to Promote Sale of Utility Securities

"SAVE with a Smile" is the title of an interesting pamphlet that is being distributed by H. M. Byllesby & Company, designed to arouse interest in thrift and systematic saving and in this connection call attention to the value of the company's securities for investment or saving purposes. Each page of the booklet contains one or more quotations from famously successful men on the value of saving or thrift. The first chapter is entitled: "Why We Should Save." Others are "Thrift," "Compound Interest," "Investment," "An Easy Way to Save and Invest" (the Byllesby partial-payment plan), "How to Judge an Investment," "Why This Is the Greatest of All Times to Save," and a final chapter on "Byllesby Sponsored Securities." A feature of the booklet is a compilation showing how rapidly wealth accumulates when certain sums are saved regularly and invested semi-annually at 7 per cent.

Sales Campaigns a Valuable Part of Merchandising Policy

THAT campaign methods are a valuable adjunct to the merchandise sales program of a gas or electric company was emphasized in the recent report of the sales campaign committee of the American Gas Association. From a survey of eighty-eight companies the committee found that 80 per cent have conducted campaigns in the past and 20 per cent have not. However, of this 20 per cent virtually all were small companies having no sales force. Of the companies which have conducted campaigns 89 per cent considered them successful, 10 per cent considered them unsuccessful and 1 per cent were non-committal. In general those companies which were not successful in their campaigns were small companies, although in one or two cases the reason given for their failure was that the campaigns were handled improperly by a special crew furnished by an outside company.

Typical opinions of the results obtained with campaign sales methods are given in the following expressions from several companies: "Sales campaigns stimulate and increase sales." "They bring to the attention of the public appliances about which they know little." "They increase sales." "They create good will." "They replace with new appliances those which are worn out and antiquated." "They add new customers." "They make selling easy." "They can be conducted successfully on a profitable basis." "The combined efforts of salesmen and advertising in the promotion of sales of seasonable appliances always produce great results."

Willful Destruction of Electrical Apparatus a Menace to Public Safety

MISCHIEVOUS breaking of insulators by stones thrown by boys caused shutdowns of from four to ten minutes on the light and power system and twenty minutes on the railway system of the British Columbia Electric Railway of Vancouver, B. C., as well as the Western Power Company on Dec. 20. Short-circuiting of the high-tension lines threw a surge onto the other circuits and caused the interruption, which occurred at 2 o'clock in the afternoon while the streets and stores were filled with Christmas shoppers.

Why the Power Went Off

The British Columbia Electric Railway regrets the shutdown of electric power on its and the Western Power Company's whole system yesterday afternoon.

The cause was the mischievous breaking of ten insulators on high-tension poles in North Vancouver by boys, according to the evidence available.

As a result, light and power circuits were out four or more minutes, depending upon the district, and the railway lines up to twenty minutes.

Such willful destruction of electrical apparatus, on which the life of the community depends, is punishable under the criminal code, because the cessation of electric current for a moment is liable to cause death (in hospitals), injury to person and loss and destruction to property.

We take this opportunity to acquaint the public with the circumstances surrounding this case, in order that they may co-operate in safeguarding the public service and preventing any recurrence of such criminal interference with the service on which the community relies.

British Columbia Railway Company

STATEMENT ISSUED EXPLAINING SERVICE INTERRUPTION

To explain the situation to the public and call attention to the dangerous consequences of malicious destruction of electrical apparatus the company issued the accompanying statement in the daily newspapers. It is also offering a reward for the arrest and conviction of the persons causing the damages.

That there was no more serious result attending the interruption than the inconvenience to the public is indeed fortunate. Throwing stones at insulators or using them for target practice has long been a favorite pastime, and—more is the pity—the mischievous small boy is not the only offender. Fatal accidents have been caused by various kinds of tampering with transmission lines and their appurtenances. Legislation, warning signs and safety rules are all designed primarily to protect the human being against himself, yet there is a type of individual who will not learn until it is just too late.

Power companies have "gone" the limit to make their apparatus safe and as far as possible foolproof, and they are not responsible for the person who deliberately contributes to his own destruction.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

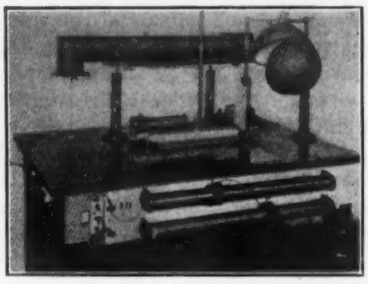
Efficiency of Adjustable-Speed Motors.—R. W. OWENS.—The author enumerates the common methods of speed control for direct-current motors and alternating-current motors. He states that although it is impossible to give data for the effect on efficiency of speed variation which would be applicable to all types of motors, it is possible to arrive at a few simple rules for estimating with fair accuracy the efficiency for any change of speed of any motor.—*Electric Journal*, January, 1921.

A Large Converter.—P. HARTIG.—Lack of space prevented the Peiner rolling mills (Germany) from installing several needed synchronous converters, and a special converter therefore was built which is rated at 5,000 kw. on the direct-current side. The machine has twenty-eight poles and makes 215 r.p.m. It is capable of delivering 9,600 amp. direct current continuously at 520 volts. A 265-kva. induction regulator on the input side provides means for regulating the voltage. The machine is started by means of a 165-kw. direct-current motor. The converter is provided with interpoles, compensating windings, etc., and many other refinements are features of the design. To prevent accidental runaway, the machine has two tachometric dynamos. One of these starts a siren whistling when the speed exceeds normal by more than 5 per cent, and the other dynamo operates tripping relays, so that the converter is disconnected on both the alternating-current and the direct-current side if the speed rises 12 per cent above normal. The over-all efficiency of this converter is about 94 per cent, as against 81 per cent reached by the 970-kw. converters installed earlier at the plant. At an average load of 4,000 kw. the converter thus saves about 4,900,000 kw.-hr. a year. The big converter, asserted to be the largest in the world, was built by the Siemens-Schuckert works, and another converter of just the same type has recently been ordered from the same concern.—*Stahl und Eisen*, 1920, page 845; also *Elektrotechnische Zeitschrift*, Oct. 21, 1920.

Lamps and Lighting

Pleasing Proportions of Direct and Diffused Light from a Floor Lamp.—J. R. CRAVATH.—This paper gives the results of preference tests on twenty-five observers as to the most pleasing proportions of direct and diffused light from a floor lamp under certain specified conditions in a given living room. Curves and tables show the range of illumination and brightness offered and the proportions preferred, also the distribution of the light flux about the lamp with the most popular proportions. —Paper presented at the convention of the Illuminating Engineering Society, Oct. 18, 1920.

Commercial Photometry.—A. L. POWELL and J. A. SUMMERS.—The authors believe that distribution curves of lighting devices or the results of photometric tests are often misinterpreted. They point out some of the features frequently overlooked. The selection of equipment for tests and some of the diversified factors in illumination problems receive careful consideration. It is pointed out, furthermore, that there are many phases of light measurements which do not come under the category of laboratory methods and which only come to the attention of the investigator through actual experience. Several of these features are briefly discussed. —*Bulletin L.D.-122, Edison Lamp Works*, October, 1920.



A 12-IN. (30-CM.) SPHERE PHOTOMETER FOR TESTING MINIATURE AND LOW-WATTAGE LAMPS

Generation, Transmission and Distribution

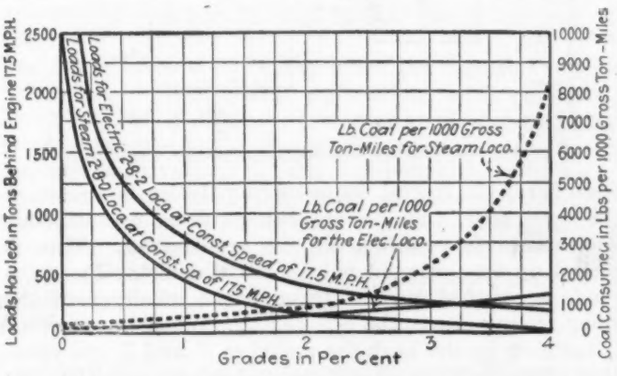
The Switchgear Problem in the Power House.—R. A. R. BOLTON.—The proper arrangement of the main wiring and equipment in the generating plant is considered in connection with typical plant connections. The author then discusses the insertion of current-limiting reactors to reduce the effects of short-circuit currents. —*English Electric Journal*, October, 1920.

Water Power in Germany.—The necessity to save Germany's coal supply has given much impetus to old and new plans for utilizing the hydraulic power available in German rivers and streams. Quite in line with the general political situation is the tendency toward a "socialization" of the electrical power industry. On the last day of December, 1919, a bill of the most far-reaching consequences was passed. This bill gave the national government the power and right to use or take over, at a "fair" price, all plants used for the interconnection of power stations and for transmission of electric energy at a tension of 50,000 volts or more, and all privately owned generating plants with an installed machine capacity of 5,000 kw. or more, except those used almost exclusively to supply the needs of the owners themselves. In certain other cases the government received the right to require that the ownership of plants be transferred to semi-official companies with the government as a shareholder. The original owner of the plants then receives his compensation in the form of shares in the new company. In an article in the *Elektrotechnische Zeitschrift*, Sept. 23, 1920, Sympher discusses the consequences of the electric power bill and also deals with some questions bearing upon the relations between hydraulic power development and internal waterways. The tendency is to combine canal and power interests in the hands of state-backed companies. The return from a hydro-electric development thus may be made to carry a canalization project which is by itself economically impossible. An example is the Neckar Canal, where the shipping business according to estimates would run with a clear loss of 3,400,000 marks

a year, while the net income from sales of electric energy, made available by a complete hydraulic regulation including canalization would be 6,600,000 marks, giving a net income of 3,200,000 marks for the combination. The work on such a combined development is to be started immediately, and the national convention already has forwarded 10,000,000 marks for the first year's expenses. Sympher, in the article referred to above, also describes a great number of similar projects concerning the Rhine, Main, Isar, Inn and other rivers in Germany. The technical difficulties in dealing with large quantities of water at low heads are discussed by Block in the *Elektrotechnische Zeitschrift* of Sept. 30, 1920. The new Kaplan low-speed turbine is said to be of great importance for low-head developments. If used in connection with herringbone drives with ratios up to one to seven, it permits the use of generators with a reasonable number of poles. In a report to the national convention Koehn has estimated the available twelve-month power in post-war Germany at 350,000 kw., the nine-month power at 890,000 kw. and the six-month power at 1,200,000 kw., while he considers a total installment of 1,700,000 kw. necessary for a complete utilization of all hydraulic resources. Halbfass, in the *Elektrotechnische Zeitschrift*, Oct. 7, 1920, quoted these and other figures from Koehn, adding the remark that the Koehn estimates appear to be 25 per cent too low.

Traction

Electrification of the Indian Railways.—A paper which enumerates the advantages of electrification of


Loads Hauled in Tons Behind Engine 17.5 M.P.H.
Coal Consumed in Lbs per 1000 Gross Ton-Miles
Grades in Per Cent
Loads for Electric 2-8-2 Locs at Const. Speed of 17.5 M.P.H.
Loads for Steam 2-8-2 Locs at Const. Sp. of 17.5 M.P.H.
Lb. Coal per 1000 Gross Ton-Miles for Steam Loco.
Lb. Coal per 1000 Gross Ton-Miles for the Elec. Loco.

REDUCTION IN HAULING CAPACITY OF STEAM LOCOMOTIVES ON HEAVY GRADES ENTAILED BY INCREASING SPEED TO 17.5 M. P. H.

	Steam Locomotive	Electric Locomotive
Total weight, tons	117.7	89
Adhesive weight, tons	63.1	63

Indian railways, including a comparison between steam and electric locomotive performances. — London *Engineer*, Nov. 26, 1920.

Electrification in East Prussia.—Under the name of Oestpreussische Aktien-Gesellschaft a public service company has been formed for the immediate and systematic electrification of the province East Prussia. The company proposes to build two hydro-electric plants in the lower part of the River Alle, about 55 km. (34 miles) from Königsberg. One of these plants will be operated as a top station with 10,500 kw. maximum capacity, at a maximum head of 14 m. (46 ft.), and the other will be run continuously at a maximum head of 6.5 m. (21 ft. 4 in.), developing 1,700 kw. Both plants are to be interconnected with the 15,000-kw. steam generating station in Königsberg and will supply some 35,000,000 kw.-hr. to the common distribution system. For transmission and interconnection about 640 km. (400 miles) of high-tension lines are to be constructed, and in addition 5,700 km. (3,550 miles) of lines for medium voltage will be needed to supply the two thousand transformer stations to be erected all over the country. Every consumer with a direct connection to the network must pay for the necessary transformer and housing and also has to pay a sum once for all for the privilege of being admitted. Needed lightning and small power distribution networks are constructed and operated by the power company if the communities themselves do not care to own their distribution systems, but the necessary funds must then be supplied to the company as a loan from the served communities. — *Elektrotechnische Zeitschrift*, Sept. 16, 1920.

Power Plant to Be Constructed at Spuller Sea for the Austrian Railroads.—In connection with the electrification of certain railroad stretches in Austria a power plant with an ultimate capacity of 48,000 hp. is being built at Danofen. The plant is intended to have a hydraulic regulation period embracing one whole year. The drainage area is 10.7 sq.km. (4.1 sq.miles) with an average run-off of 17,250,000 cu.m. (610,000,000 cu.ft.) of water per year. By damming up Lake Spuller at an altitude of 1,800 m. (6,000 ft.) a hydraulic storage of 13,500,000 cu.m. (480,000,000 cu.ft.) capacity is obtained. The storage basin thus takes in nearly four-fifths of the whole year's water supply. The power house will ultimately be provided with six high-pressure turbines of 8,000 hp. each, working at a head of 800 m. (2,600 ft.). This development is to be carried out gradually during a number of years. At present a smaller dam is constructed, while only three turbines are being installed.—*Elektrische Kraftbetriebe und Bahnen*, July 14, 1920.

Installations, Systems and Appliances

Enameling in the Automobile Industry.—M. R. ARMSTRONG.—The author holds that great progress has recently been made in the manner of applying paint and enamel to automobiles. The gas oven, he asserts, is supplanted by electrically heated ovens. Methods used in the Jordan Motor Car Company and the Cleveland Automobile Company and the results of tests made on their electrically heated ovens are discussed. Typical

OPERATING CHARACTERISTICS OF ELECTRIC OVEN

Bake	1	2	3	4	5	6	Avg.
Pounds baked	555	293	1,043	683	381	638	597
Minutes for dipping	21	12	22	23	14	16	18
Minutes for dripping	37	53	37	36	44	41	41
Minutes baking	72	60	60	60	65	45	63
Kw.-hr.	65	67.2	78.4	57.6	54.4	52.8	67.7
Lb. baked per kw.-hr.	9.8	4.4	13.3	11.8	7.0	12.1	9.0
Minutes current was on	22	22	28	21	20	19	22

operating characteristics of these electric ovens are given in the table.—*Electric Journal*, January, 1921.

Typical Relay Connections.—LEWIS A. TERVEN.—Reference is made to the series of articles on the subject which appeared in the *Electric Journal* during 1908 and 1909. This article, it is said, is the first of a series which have been written to bring the former articles up to date and to give information regarding present switchboard practice in relay connections.—*Electric Journal*, January, 1921.

Electrophysics and Magnetism

Mathematical Analysis of the Mechanical Forces Acting on Switches and Busbars.—L. B. W. JOLLEY.—The author offers a criticism of the method of calculating the forces on switches and busbars during periods of short circuit which is known as "action at a distance." He then explains the "energy" method, which he holds should be substituted for the first-mentioned method. The author suggests that his formulas will serve the dual purpose of insuring a correct fundamental view of the method of dealing with problems of this nature and of presenting such a view in a practical form which will be of use to designers of switchgear and station equipment.—London *Electrician*, Dec. 3 and 10, 1920.

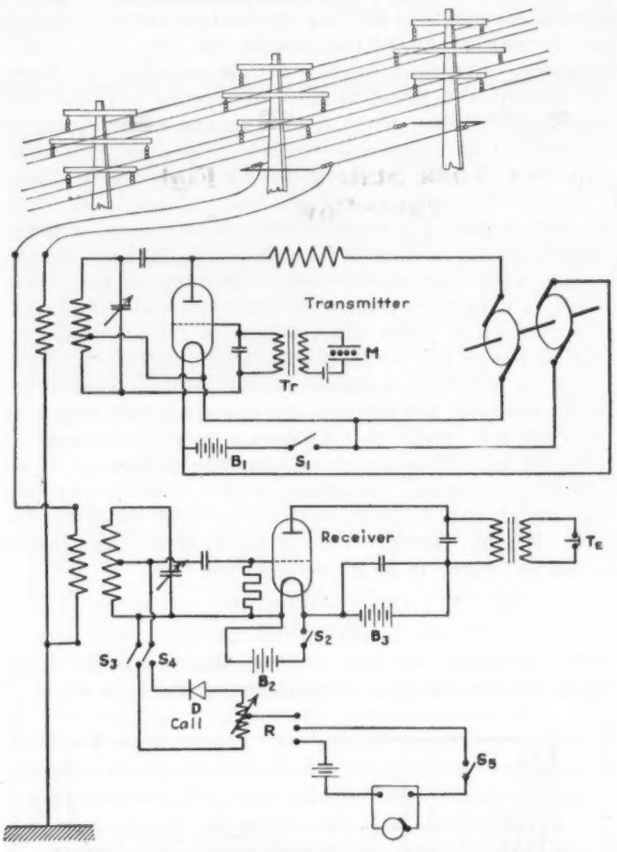
Skin Effect in Round Conductors.—BREITFELD.—The Kelvin theory of skin effect in round conductors is further developed by the author, who takes into consideration the possibility of a dielectric displacement current inside the conductor itself. The solutions come out in the form of Bessel's functions of complex arguments, and by aid of these functions the resistance and inductance per centimeter conductor can be computed as functions of the frequency. The author states that the metals may have a dielectric constant ε of the order of 10^{13} in the electrostatic system, but does not offer any experimental evidence substantiating this hypothesis. The resistance and inductance per unit length, according to the developed theory, at extreme frequencies both tend toward constant limiting values, which are simple functions of the permeability and of the hypothetic dielectric constant of the metal, thus permitting an experimental determination of ε.—*Elektrotechnik und Maschinenbau*, Nov. 14, 1920.

Units, Measurements and Instruments

Integrating Wattmeter Accuracy and Testing Practice.—W. K. HERVEY.—The importance of proper setting of permanent magnets is brought out, the effects of dust on bearings and lubrication are dealt with, and the accuracy requirements of various state commissions are given.—*Electrical Review*, Dec. 18, 1920.

Telegraphy, Telephony and Signals

Conductor-Directed Wireless for Interplant Communication.—GEWECKE.—The Telefunken company has developed into commercial form a system for wireless telephony especially adapted for intercommunication between high-tension stations at great distances. The signals, talk, etc., are not transmitted by ordinary wireless, but the property of a conducting wire to direct the electromagnetic waves and thus cut down energy dispersion is made use of in the following way: An ordinary set for wireless telephony, with triode oscillators, for continuous oscillations, feeds into a small antenna hanging between two transmission-line poles parallel to the high-tension conductors. At the receiving end of the line there is a similar antenna connected to wireless telephone receiver. Two-way communication may be obtained either by using two antennas at each station or else by coupling to the same antenna one receiver and one transmitter, tuned to different wave lengths. Experience shows that the energy will follow the transmission conductors without much dissipation so that very great distances may be covered with a quite limited primary energy. The author describes a conductor-directed wireless installation at the Zschornewitz (Germany) plant, where quite good communication is obtained over the 135-km. (84-mile), 110,000-volt line from Golpa to Rummelsburg. The connections are indicated in the figure. A 10-watt or 20-watt, three-electrode tube set serves as a source of energy, and the receiver simply contains a modulating tube, without any



STATION FOR CONDUCTOR-DIRECTED RADIO TELEPHONY

amplifiers. A special call-receiving device is shown in the lower part of the figure. When calling, a continuous wave train is sent out by the transmitter. This is picked up by a rugged but sensitive detector *D*, which sends a rectified current through the windings of the relay *R*, and starts the bell calling. When the receiver is hanging on the hook the switches S_1 and S_2 are open, thus disconnecting the filament batteries of the two bulbs, and the call device switches S_3, S_4 and S_5 instead are closed. As soon as the receiver is lifted from the hook the bell stops and the vacuum-tube filaments light up, thus putting the station in talking order. The tube replacement cost is estimated at 120 marks (about 35 cents) a year for a daily half hour of conversation. The communication is very little affected by disturbance on the lines, and even with a short circuit with intermittent arcing, a quite clear communication is maintained. —*Elektrotechnische Zeitschrift*, Aug. 26, 1920.

Undamped Oscillations in Coupled Circuits.—The author shows that any problem involving inductive coupling may be algebraically treated in just the same way as a case of parallel connection of two branches. This method of dealing with problems of stationary oscillations in coupled circuits is applied to some practical cases, and an explanation is given of the sudden frequency changes which may sometimes be observed when tuning up an arc oscillation generator to an inductively coupled antenna circuit.—*Elektrotechnische Zeitschrift*, Dec. 2, 1920.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

New York State Opens Fight on Water-Power Act

OBJECTIONS have been filed by the Attorney-General of the State of New York to the applications made by twelve western New York associations and corporations for leave to divert and utilize the waters of the St. Lawrence and Niagara Rivers for power purposes. The objections will be argued before the Federal Power Commission at a hearing in Washington, Jan. 24.

The action represents the State's first attack on the water-power act, which permits the Federal Power Commission to exact a rental for use of the water of boundary streams and gives the commission jurisdiction over water-power sites on boundary streams. If the objections filed are over-ruled, it is stated that the state will institute an action to test the validity of the law as well as proceedings held by the Federal Power Commission to determine the relative power of the state and federal government in connection with the licensing and use of such waters for power purposes.

The State of New York has taken the position that the province of the federal government with respect to these waters is limited to taking such steps with respect to the use made of them for water-power purposes and with respect to dams and structures to be erected as will insure that they do not operate to impair the navigability of the streams. The state insists that the financial benefits derived from the use of surplus waters shall go to the state rather than to the federal government.

Lower Living Costs Bring Lower Wages to St. Louis Utility Employees

THE Union Electric Light & Power Company, St. Louis, Mo., has announced that the wages paid to 1,400 of its employees and to 150 of the employees of the St. Louis County Gas & Electric Company, a subsidiary, have been reduced by an average of 8 per cent, effective Jan. 1, 1921, "due to a declining cost of living."

The reduction is according to the terms of a perpetual wage agreement between the companies and their employees, represented by the employees' mutual benefit association, entered into on May 22, 1911, which provides for wage adjustments every six months. A stipulation is that in such adjustments the cost of living shall be reckoned as approximately a two-thirds factor. The cost of living is to be measured by the *Annalist* "Index Number of Cost of Living," which is a compilation of the wholesale price of twenty-five articles regarded as comprising the food budget of the average family. The other factors governing the wage adjustments are length and proficiency in service.

The employees have invoked the contract at six-month intervals and have obtained advances totaling an average of 84 per cent since May, 1918. The invocation of the contract at this time was by the company.

The wage adjustment now made effective was recommended by a board of adjustment, comprising two employees selected by the benefit association, two persons selected by the company and a fifth one selected by the other four. The finding of the board of adjustment was accepted by the general labor committee of the association in behalf of the employees and by the company.

Delay in Water-Power Personnel Amendment May Hold Up Permits

DELAY in reporting out the amendment to the water-power act by the select committee on water power of the House of Representatives makes it appear doubtful if legislation empowering the Federal Power Commission to hire its needed staff can be obtained at this session of Congress. Since an extra session of Congress is to be called late in March or early in April, there still will be time to pass such an amendment before the end of the fiscal year. This also would be the basis for securing additional appropriations. Valuations cannot be started and no license probably will be issued until additional funds are made available. The present arrangement of borrowing help from the Departments of War, the Interior and Agriculture also is endangered by the heavy reductions being made in departmental appropriations.

Massachusetts Public Utility Financing May Be Aided by Legislation

THE Massachusetts Gas & Electric Association has filed four bills, designed to facilitate financing utilities, for consideration by the present Legislature. The first bill is to authorize the issue by gas and electric companies of capital stock without nominal or par value. This bill seeks to authorize any company desiring to do so to call in and retire its outstanding capital stock having par value and issue in place of it stock without nominal or par value. Such laws have been passed in a good many states, and among others in Massachusetts, but the Massachusetts act at present applies only to business corporations and not to public service corporations.

The second bill is one to equalize the cash and share capital of certain gas and electric companies. It specifically provides that any gas or electric company which has received in payment for its outstanding capital stock more than its aggregate par value may under the provisions of the act issue additional shares at the par value thereof to an amount equal to the difference between the aggregate par value of its then outstanding capital stock and the total amount received in payment

for it. The purpose of this is to extinguish artificial par values of stock, which rarely, if ever, correspond to the fact, and to authorize corporations issuing par value stock to issue it to the extent to which it is paid for at par. That requires the approval of the Department of Public Utilities, which is required to audit the capital accounts of the company and find out what the actual amount of money paid in has been.

A third bill provides that the Department of Public Utilities shall have authority to authorize the issue of stock at less than its par value, making such requirement as may be thought necessary for the amortization of the discount; provided, however, that the commissioners shall find that such issue is reasonably necessary for the purposes of the company and that, in the opinion of the commissioners, it cannot be disposed of to the stockholders or others at or above the par value thereof.

A fourth bill authorizes the issue of bonds at such price and bearing such interest as may be approved by the Department of Public Utilities. It is merely an extension of Chapter 581 of the Acts of 1920 and is for the purpose of meeting the radical changes which have recently taken place in financial conditions.

Worcester Company Suffers Slight Loss in Serious Fires

TWENTY-EIGHT fires occurred at Worcester, Mass., on Jan. 19, chiefly in the business and manufacturing center, with an estimated loss exceeding $1,600,000. President R. W. Rollins of the Worcester Electric Light Company informed the ELECTRICAL WORLD by telephone that little damage was done to the company's property and that its losses were chiefly confined to meters and would probably be well under $1,000. Elevator service in the City Hall district was somewhat impaired for a short time, and the Chase Court substation was threatened with water damage which fortunately did not prove serious. Underground service supplies substantially the entire district affected, and the absence of overhead wires proved a great advantage.

Murray Declares Superpower System Must Have Adequate Return

SPEAKING before the Boston Sections of the A. I. E. E. and A. S. M. E., and the Boston Society of Civil Engineers on Jan. 18, W. S. Murray, chairman of the Superpower Survey, declared that a return of at least 10 per cent on the investment will be necessary at present for the success of the program, and that if the yield should be limited to 6 per cent the project would be doomed to failure. The speaker said that while the initial construction expedient for the system is unsettled, a 300,000-kw, steam plant and a superpower transmission line from the Hackensack Meadows to Philadelphia would pay now. Not a dollar has been sought from the United States Treasury for financing the proposed superpower development, Mr. Murray said, and he strongly affirmed the intention of those interested in the scheme to keep clear of the morass of government ownership or operation. It has not yet been determined whether it will be better to operate through a federal charter or through synchronized state charters. Consideration is being given to transmission of hydroelectric energy from the St. Lawrence River in connection with the superpower project. It is estimated that by 1930 the present general plan, if carried through, will save 50,000,000 tons of coal and that between now and then the energy requirements of the so-called Superpower Zone will be about doubled. In the forthcoming report problems of industrial and generating-plant heat balance will receive special attention.

Security Issues of the Week Reach Total of More than $12,000,000

THREE large issues of securities have been announced this week by lighting and power companies. The largest of these issued is $7,500,000 in two-year 8 per cent coupon gold notes by the United Gas Improvement Company of Philadelphia, designed to retire notes of the same amount which mature on Feb. 1. The Mississippi River Power Company is floating $3,600,000 in fifteen-year 7 per cent sinking fund gold debentures, also for refunding purposes. The specific purpose of the Southwestern Power & Light Company's issue of twenty-year 8 per cent bond-secured gold notes is not stated in the advertisement announcing them. The U. G. I. notes are offered at 99.45 and interest, to yield about 8.30 per cent; the Mississippi River Power debentures at 91⅜ and interest, to yield 8 per cent, and the Southwestern Power & Light notes at 97 and interest, to yield about 8.30 per cent.

Marine Electrical Engineering to Be Discussed in New York Next Week

MARINE electrical engineering is the subject of the joint meeting of the New York sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers to be held on Jan. 28. Alfred E. Waller, chief engineer of the Ward Leonard Electric Company and chairman of the marine committee of the A. I. E. E., will preside. The opening remarks are to be made by Admiral W. S. Benson, chairman of the United States Shipping Board. The following papers are scheduled to be presented:

"Electricity Applied to Ship Auxiliaries," by H. L. Hibbard, manager marine department Cutler-Hammer Manufacturing Company and formerly chief of the bureau of construction and repair of the United States Navy. This paper treats the subject historically and gives efficiency data where Diesel engines instead of steam power have been used to drive ships' auxiliary motors.

"Electrical Terminal Facilities," by Commander C. S. McDowell, U. S. N., inspector of engineering material. This paper considers facilities for loading and unloading ships to get the greatest possible effective service.

"Electric Ship Propulsion," by Eskil Berg, engineer of the turbine department General Electric Company. In this paper the author discusses the relative merits of steam turbines geared directly to the propeller and steam turbines with generators and motor drives. The conclusion drawn is that the motor drive is preferable except in some special cases.

"Ship Propulsion," by Walter Thau, marine engineer Westinghouse Electric & Manufacturing Company. A description of the turbine drive of the U. S. S. *Tennessee*.

Written discussion by a number of prominent marine electrical engineers has been prepared for presentation.

Great Falls Hearing Postponed

IN ORDER that the chief of engineers may have more time in which to review the report made by Major Max Tyler on the possibilities of water-power development at Great Falls, on the Potomac, the hearing on that project scheduled for Jan. 20 has been postponed. Another date will be set when the chief of engineers shall have concluded his review of the report.

Southern California Edison Company Issues $10,000,000 in Bonds

THE Southern California Edison Company has been authorized by the California Railroad Commission to issue $10,000,000 face value of its general and refunding mortgage 6 per cent twenty-five-year gold bonds. The company also has been given permission to use not over $3,000,000 of these bonds as collateral securities for short-time loans. It is understood that the sale of the bonds has been completed and they are now being offered to the public on a basis to yield about 7 per cent.

Permanently to finance its properties already constructed and to carry forward its construction program during 1921, the Southern California Edison Company has prepared a budget calling for an expenditure of $20,000,000, of which half will be supplied by this bond issue. It is planned to raise the additional $10,000,000 through the sale of stock in the territory served, and extensive plans are being made to accomplish this. The greatest amount of stock sold in any one previous year has been approximately $5,000,000.

Synchronous Motors Favored for Rubber Mills

EMPHASIS was placed on the use of synchronous motors and direct-motor drive at the Akron-Cleveland meeting of the American Institute of Electrical Engineers on Jan. 14, when William E. Date, chairman of the sub-committee of the industrial and domestic power committee on the rubber industry, pointed out the possibilities of improvement in the use of power by the proper study of the application of motors to the various machines in the rubber factory. The question whether electrical efficiency had been sacrificed by splitting up the motor equipment into a large number of units to get production efficiency was raised, but not answered, Mr. Date indicating that the answer will depend on determining whether any sacrifice in efficiency from the power viewpoint means a total saving in production costs. The committee report suggests the advisability of grouping, as far as possible, the units of any one process into one mill drive where possible, also the units should have contrasting characteristics to improve motor-load factors and avoid the tendency toward overmotoring that exists where the use of individual drive is carried out.

In the discussion the use of synchronous motors was very strongly advocated, B. H. Clingerman pointing out that poor power-factor conditions were due in large measure to underloaded motors and that the larger-sized motors in many cases could be used advantageously. On breaking-down operations they can be adjusted to operate at unity power factor and used to correct the power factor due to the smaller-sized motors that are necessarily of the induction type. A considerable difference of opinion on the use of gear or direct drive developed, A. T. Lewis asserting in a written discussion read by B. T. Mottinger that the replacements in some cases had been of the order of one in five hundred gear-years' life, while others asserted that an expense of $500 per year was required to keep herringbone gears in order. C. A. Rice cited one case where a direct-current direct-mill drive had been in service since 1908 with no expense of upkeep and said that future installations would be of this type with alternating-current motors. In Mr. Lewis' discussion objection was made to the low-speed slip-ring motor for direct drive on the ground of its size, and because it is not economically justified.

Industrial heating was brought up by W. S. Scott, who thought that future demand might possibly be as great for power for this purpose as for motor applications, and the suggestion was made by A. M. McCutcheon that the better control of heat possible with electric heating might result in a better product.

Safety stops that would act quickly enough to prevent serious accidents were discussed. Some form of brake that would result in a quick stop rather than a clutch was favored. Instances of brakes that would stop a 450-hp. motor in three and one-half to four revolutions were given.

The use of heavy flywheels to reduce the magnitude of the sudden peaks was suggested by H. McFarland, but J. H. Vance and B. T. Mottinger pointed out that the peaks in machine operation were so long continued that the flywheel effect was lost.

Washington Cities Want Right to Sell Power Outside Their Territory

A BILL drawn up by city attorneys of western Washington to be introduced in the Legislature this session provides that any city in the State of Washington may acquire the right to sell electrical energy outside its territory. The bill provides that cities or towns so served must own their own distribution systems. The act as drawn up further provides for the sale of electric power to industries or corporations within 1 mile of the transmission line. Theb ill is backed by Seattle, Tacoma and other Puget Sound cities.

Senate Passes Bill to Place Muscle Shoals Under Government Corporation

THE bill to provide for a government corporation to operate the Muscle Shoals nitrate plant was passed on Jan. 14 in the United States Senate by a vote of 34 to 29. The bill provides for a corporation with $12,500,000 capital stock, owned by the government and managed by a board appointed by the President and under the jurisdiction of the Treasury Department.

The bill also would require the nitrate corporation to issue bonds up to half of the expenditures of the government in construction of the nitrate plants and for full value of hydro-electric installation at Muscle Shoals, if taken over by the corporation. The corporation also would be required to earn 5 per cent interest on these securities under penalty of ceasing operation to await further dispensation from Congress. An amendment relieving the government from responsibility for debts of the corporation was also passed by the Senate. Another amendment adopted took from the proposed corporation all right to condemn or acquire property by right of eminent domain.

California Commission Under Fire by Legislature

CLAIMING that a number of the recent decisions made by the California State Railroad Commission have been unfair to the consumers, and discriminated in favor of the public service corporations, members of the State Legislature have proposed a thorough investigation into the conduct of hearings before the Railroad Commission and into the decisions rendered.

Massachusetts Commission Seeks to Regulate Service Charges

THE power to annul or modify any service or similar charge adopted by a gas or electric company on its own initiative is sought from the Massachusetts Legislature by the Department of Public Utilities in a special report signed by the full board. The department is not of the opinion that service charges should be indiscriminately adopted, but is convinced that such charges may not only be justified at times—notably in companies handling exceptional summer loads—but may be in some cases perhaps the only practicable means of adjusting fairly the relative payments which the customers should make for the services rendered them.

Common Interest of Utilities and Public Is Theme of Indiana Meeting

THE intimate association of the interests of the utilities and the public, a relation so close that they prosper or suffer together, was proclaimed by Paul P. Haynes, a member of the Indiana Public Service Commission, in an address before the first annual meeting of the Indiana Public Utility Association at Indianapolis on Thursday of last week. This association was formed to sponsor the Indiana Committee on Public Utility Information, which devotes itself to promoting general acquaintance with utility problems and to fostering good public relations. Mr. Haynes combated the contention that there are two sides to the utility business and contended that there is only one. He specified seven things that should be brought plainly before the people. Briefly summarized these are: (1) That increases in utility rates in the last four years have been much less than increases in the price of other necessities; (2) that utilities generally have earned less than a fair return; (3) that existing rates are not based on the peak war costs; (4) that deferred maintenance expense has reached an immense total and must be provided for; (5) that Indiana utilities should expend $100,000,000 in the next two years for extensions and improvements; (6) that impaired utility credit must be restored through increased revenue; (7) that a sympathetic understanding of these facts by the public is essential in its own interest. Good service, Mr. Haynes said, is the primary obligation of the utility, and it is the duty of a commission to see that the utility is in a condition where it can give such service.

Martin J. Insull, president of the National Electric Light Association, took issue with Mr. Haynes' assertion that service was the first consideration. Service and rates, in Mr. Insull's opinion, must go together, for good service is impossible with inadequate rates. Where the utilities of a community are run down the community itself is going backward. The present, Mr. Insull held, is the right time to educate the public both by the printed word and by word of mouth. He dwelt on the exhaustion of utility reserves and the slow turnover as compared with other businesses and concluded by a reference to the national good-will advertising campaign of the N. E. L. A.

E. K. Hall, vice-president of the American Telephone & Telegraph Company, discussed the question of how to make the public understand that the period of punishment for former misdeeds on the part of some utilities is past and that the second era of regulation, devoted to making and keeping the companies strong enough to do their work, is here. It was time to stop apologizing and to take the aggressive.

The following officers were elected for the ensuing year: President (re-elected), Charles L. Henry, president Indianapolis & Cincinnati Traction Company; first vice-president, S. E. Mulholland, vice-president Northern Indiana Gas & Electric Company; second vice-president, F. J. Haas, vice-president and general manager Public Utilities Company, Evansville; secretary, Marshall V. Hoff, treasurer Wabash Valley Electric Company, Clinton; treasurer, Charles C. Perry, president Indianapolis Light & Heat Company.

Missouri Bill Would Abolish Public Service Commission

A BILL to provide for the repeal of the law creating the Missouri Public Service Commission was introduced into the Missouri House of Representatives by Representative Chaney of Kansas City on Jan. 13. The proposed measure covers only a few lines and provides for the repeal of the whole law relating to the creation and scope of action of the Public Service Commission. In introducing the bill Representative Chaney declared he did so because of the sentiment in the state for abolition of the commission on account of the increased rates granted utilities during the past three years.

According to advices from Jefferson City, there is apparently a great deal of sentiment in the House against the commission, but it is not believed that the bill will receive sufficient support to pass it. If the measure should pass the House, it is doubtful if it will receive favorable action in the Senate. A similar measure introduced two years ago was killed in committee.

Judge Wade Condemns Propaganda Against Utility Commissions

DECLARING that two-thirds of the difficulties in public utility matters arise out of a misunderstanding or lack of information upon essential fundamental considerations, Judge Martin J. Wade of the United States District Court of Iowa a few days ago granted a temporary rate increase to the Des Moines (Iowa) Gas Company. "There seems to be a determined effort on the part of some individual or individuals in every city to carry on propaganda which inspires doubt and suspicion," Judge Wade continued. "This aims to destroy confidence in officers of the law who have duties to perform in relation to public utility matters and to convince the people that they are being robbed in the interest of certain corporations. The people will be fair if they only understand, and those who spread misinformation and misrepresentation are guilty of a grave wrong against the community."

Water Storage Essential to Western Development

FUTURE hydro-electric development must carry with it ample and well-surveyed storage. This declaration is one of the anxioms laid down by A. G. Wishon, vice-president and managing director of the San Joaquin Light & Power Corporation of Fresno, Cal., who is in the East this week and was asked by a representative of the ELECTRICAL WORLD to give his views on the water-power situation in the West, its determining features and what its development means not only to the coast but nationally. It will be remembered that Mr. Wishon, with his son, A. Emory Wishon, who is now general manager of the Fresno property, advanced and advocated the widely discussed "self-interest" plan for financing electric power development which has been so successful in California.*

HEAVIEST LOAD IN DRY YEAR

"As a chain is no stronger than its weakest link, so is a hydro-electric development no greater than its dependable storage," said Mr. Wishon, mindful of the California power shortage that because of low water occurred last fall. "The driest year is the year of largest kilowatt-hour output. The drier the year the more the water is needed by the farmer and the larger is the irrigation pumping load. This load, therefore, can be served properly only with adequate storage.

"Power companies can make no progress talking electrification to steam railroads until they can first prove that service will be continuous even under the most adverse conditions. That is reasonable because the railroads must always be in continuous operation. Storage, then, is the only answer."

At this point Mr. Wishon pointed out that water power is absolutely essential to the West. The cost of coal for power production is prohibitive. The available fuel is oil, and the supply of that is limited, while the cost in its case also is becoming prohibitive. It is evident, therefore, Mr. Wishon pointed out, that if the West is to continue to serve the country in an ever-increasing measure a progressive development of its water powers is an economic necessity.

NATIONAL PARK DANGER

"It is to the 'self-interest' of the nation," he pointed out, "that the waters miles back in the mountains be stored and put to work. There are some people, however, who in their zeal to create in the undeveloped West vast national playgrounds will not heed the economic needs of the nation. They would forever prohibit any development of waters now running to waste not only in the present national parks but in the proposed enlarged parks. This is dangerous.

"The public utilities do not object to withholding the waters within the present national parks. They do, however, see the danger of eliminating from the provisions of the water-power act national parks except as now constituted. If the program of the national park enthusiasts is carried out these parks will ultimately cover the high range from Greene Horn Pass near the mouth of the Kearn River on up, taking in the Klamath and Crater Lake country, which includes Tahoe and all the intervening territory. Were this excluded from the provisions of the water-power act it would shut off the possibility of power development and, what is more important, water storage for both power and irrigation throughout the entire Sierra Nevada Range."

When asked how much of the available storage would thus be shut off Mr. Wishon said he did not know positively because existing water-storage data were unreliable. He ventured to guess, however, that fully 50 per cent of available storage would be shut off were national park enthusiasts to have their way unchecked.

"It is perhaps difficult for the great mass of people who have never been west of the Mississippi," continued Mr. Wishon, "to understand what water power means to the West, and especially to realize that although there is a temporary depression in the great manufacturing regions of the East the West is not so badly off and that we are going ahead now with big construction programs. They do not yet realize that we are helping to shorten this period of depression because the bulk of all the materials that we shall require must come from the East. We have had bumper crops of raisins, oranges, lemons, walnuts, prunes, rice and other things, and the money will almost all be in our hands—hundreds of millions of dollars—within a few months and, after paying the Eastern jobbers and manufacturers for the millions due for what we buy from them, will go back into the agricultural and industrial, and therefore into the power, development of the West. It is fundamental with us that the West can grow no faster than the development of its potential water powers. Is it so strange then that the 'self-interest' idea should be so strong and that money should be forthcoming from our own people for power development? The farmer and the factory owner on the Pacific Coast see these things and invest their surplus funds in power development for two reasons: First, to bring the power, so that they themselves can expand, and, second, as a safe dividend-paying investment.

A. G. WISHON

HEAVY PREPARATION COSTS

"Nor are all our powers to be developed as easily accessible as in the East. So treacherous are some of the trails that only goats and donkeys can navigate them. To secure surveys of watersheds and storage basins we have in some instances been forced to use airplanes. On the Kings River development, for instance, we have already spent more than $400,000 on engineering and road work, and we haven't yet started the tunnel excavation and dam construction. The last 3½ miles of road cost $45,000 and is not yet completed. It is estimated that the 50 miles of main road and 20 miles of laterals for the development of the north fork of the Kings River will cost $1,750,000.

"Just as soon as these roads are built we will start construction on this development. We now expect to

*See ELECTRICAL WORLD, May 1, 1920, p. 997.

get under ground during the coming winter. A series of plants is proposed with regulated storage beginning at the bottom and working up to the higher altitudes. First will come the Balch power house, with one unit using 100 sec.-ft. of water operating under a 2,600-ft. head and developing on the switchboard 32,000 kw. This will involve the storage of about 45,000 acre-ft. of water. For this development a 150-ft. dam will be erected, which later will be increased in height in two steps of 50 ft. each, making it ultimately 250 ft. high. It will require up to two years, or till the end of 1922, to complete this plant. This will be in time to fill the reservoir for the 1923 season. The second unit—the Haas power house—will operate under a little over 2,400-ft. head without increasing the amount of storage.

"In the third year there will be added a little more dam and another unit in each power house. The fourth year will see the project completed. Ultimately the stream will be regulated for 550 sec.-ft., and there will be eleven power houses located from 8,100 ft. elevation down to 900 ft. elevation for water control.

"The territory we occupy is not more than 10 per cent developed from a power and development standpoint. From this construction will come the development of the surrounding country. Agricultural expansion and the building of industries essential to the West will result.

"SELF-INTEREST" FINANCING

"All of this is being more and more appreciated by our people. So much so, in fact, that a new development has come—the placing of junior financing locally. Twenty-five per cent of our financial requirements is absorbed in our own territory. We are aiming to spend in our company alone around $10,000,000 annually, of which $2,500,000 will be provided locally by the purchase not of funded securities but of preferred stock, which is 2 per cent of the annual value of products grown in the San Joaquin Valley. Already under this 'self-interest' plan of junior financing we have placed about $1,500,000 among 1,800 new stockholders, or about $830 per stockholder, and the first year will not be up until the spring. A great many of our new stockholders are rebuying, and there is one case where a local stockholder has purchased eleven times. Not more than fifteen or twenty stockholders out of the 1,800 have canceled their orders, and these were mostly employees who left the company. We have about 800 employees—not counting the construction gangs, whom we do not urge to buy—and of these 50 per cent are stockholders. We sell our employees on a time-payment plan of $7.50 down and $10 per month per share or $1 per share less than it is sold to the public.

Achievements, Activities and Aims of Electrical Development Society

IN MANY places separate pieces of information relative to the activities and purposes of the Society for Electrical Development have been printed, but at no time until now has the entire story been embraced in one piece of literature. To do this and to inspire continued confidence throughout the industry the society is distributing an attractive booklet setting forth its achievements, activities and views. Special attention is given to its research and publication work, merchandising ireas, campaigns and field co-operation.

Definition of Purpose of Water Power League Expected

AT THE annual meeting of the Water Power League of America, held in New York on Tuesday of this week, a change in the method of electing officers was made so that the directorship and officers may be more representative of the membership, which includes many large power and manufacturing interests. A nominating committee was appointed, and its report is expected within the next two or three weeks. There has been some feeling that the purpose of the organization should be better defined, and this, it is expected, will be one of the first things the new administration will take up. It is also proposed that the association select a more representative name, and already the name "American Water Power Association" has been suggested.

New Hampshire Hydro-Electric Report Expected Soon

A REPORT to the Governor on the hydro-electric resources of New Hampshire will soon be published under the direction of George B. Leighton, Commissioner of Water Conservation and Water Power, supplementing the first report on this subject, which appeared under date of Jan. 1, 1919. In this report Commissioner Leighton will recommend the extension of storage facilities, an appropriation for the continuance of systematic stream gaging and a resumption of the topographic mapping of the state, now less than half completed, under a joint appropriation with the United States Geological Survey. Data prepared by C. H. Pierce, district engineer of the Geological Survey at Boston, as to storage possibilities and the development of potential power sites and a section of a report by Prof. C. M. Allen of the Worcester Polytechnic Institute covering sources of inefficiency in hydro-electric stations will be included in the report.

State Storage Development Favored in Maine Water-Power Report

DEVELOPMENT of storage facilities is recommended in a recent report of the Maine Water Power Commission to Governor Parkhurst. Edward P. Ricker is chairman and George C. Danforth of Augusta is chief engineer of the commission. This body was authorized to take over the water-power resources work of the Maine Public Utilities Commission and to continue the investigation of the hydraulic developments and possibilities within the state which was embodied in a special report of the Utilities Commission about two years ago.

In view of the answers of the judges of the Maine Supreme Court to the questions of the Maine House in February, 1919, it has seemed to the Water Power Commission impracticable, if not legally impossible, to work out a satisfactory plan for the state control of storage resources unless by some proper amendment of the state constitution such work could be legally recognized as a public purpose within the accomplishment of which the state could exercise the right of eminent domain or some special method of assessment of the particular interests to be benefited. If the constitution should be amended so as to make possible state control of storage facilities, the commission believes that such control could be best applied and most effectively worked

out by the creation of river regulating districts. A plan for this has been prepared for presentation in case the necessary constitutional amendment is brought before the Legislature. The commission has been unable to ascertain that the state has any rights in the storage reservoirs and in the developed and undeveloped water powers except that limited right of control of the waters of the Great Ponds as stated in the Supreme Court answers referred to. The commission recommends that its work be continued.

It is not believed that sufficient knowledge is available either of the resources of the state or of the effect on Maine of the federal water-power law for the state to commit itself to a course of storage development. Every possible effort, it is pointed out, should be made to retain within the boundaries of the state control of its own resources.

The trend of the report is against the state development of water power, with the exception of storage facilities. The importance of water-power development in Maine is strongly emphasized, and the economic benefits as set forth in the report of such development received the approval of the engineering council, which has contributed a supplementary report to be published with the main report of the water-power commission.

Would License Engineers in Missouri

LICENSING of all professional engineers in the State of Missouri by a board of engineers to be appointed by the Governor is provided in a bill to be introduced in the Missouri Legislature, it was announced after a meeting a few days ago of the newly organized Missouri state organization of the American Association of Engineers. The proposed bill affects all electrical, mechanical, structural, mining, highway and civil engineers in the state. It provides that a state board of five engineers from different branches of the profession be appointed by the Governor within thirty days after the passage of the bill, each to serve for four years, with the exception of two members of the first board who are to serve for only two years.

The proposed state board of engineers is to have authority to examine all applicants and issue licenses. A maximum penalty of $500 fine and three months' imprisonment is fixed for any person attempting to practice as a professional engineer without a license.

Wisconsin Electrical Inspectors Organize

THE initial meeting of the Wisconsin Chapter of the Association of Electrical Inspectors was held at a luncheon at the Blatz Hotel in Milwaukee on Jan. 17, given by the Wisconsin Inspection Bureau. The following officers and executive committee were elected: President, William Haig, chief inspector of the city department of Milwaukee; vice-president, R. M. Schleck, electrical superintendent of South Milwaukee; secretary, A. C. Schultz, electrical inspector of the Wisconsin Inspection Bureau; executive committee—Frank R. Daniel, chief engineer Wisconsin Inspection Bureau, chairman; H. P. Hempsing, electrical superintendent of Wauwatosa; Archie Middlemass, inspector of Milwaukee city department; W. H. Snyder, electrical superintendent of Menominee Falls; A. C. Schultz and William Haig.

Tacoma Upheld in Right to Condemn Water-Power Site

THE right of the city of Tacoma to condemn property for the acquisition of the Lake Cushman power site has been upheld in the Superior Court by Judge Wilson. The city will now proceed in accordance with an order of the court authorizing the bringing of condemnation suits and will start without delay suits to acquire lands and other property which cannot be obtained by purchase outright, including water rights, dam sites, transmission line franchises and other rights. For the acquisition of the site there is available $300,000.

Attorneys seeking to block the city's efforts took the stand that the law provides that a city may condemn a power site only if it proposes to make public use of the power. They pointed to the fact that if the city were to discontinue the sale of power for toasters, household devices, curling irons, etc., it would have sufficient energy for lighting purposes for years to come. In handing down his decision Judge Wilson said, in part:

"I cannot agree with the contention that the use of electricity in the homes of the inhabitants of the city for heating, toasters, carpet sweepers, curling irons and the like is not a public use in the light of the rapid development of electrical uses of the present day, nor do I think there is such a showing of the commingling of public and private uses as would preclude the petitioner's right to condemn."

American Capital to Finance Swiss Railway Electrification

COMPLETE electrification of the federal railway system of Switzerland within the next twenty years is included in a comprehensive hydro-electric development program laid out by the Swiss government. Electrification of two railroad divisions, one from Luzerne to Bellinzona and one from Berne to Domodossola, Italy, was recently completed and operation has begun, while the work on two others is now under way. At the Swiss Consulate in New York it was stated that the plan contemplates full electrification of all main lines within six or seven years, and branch roads of the second and third class are to follow within the time limit set. Extensive hydro-electric developments have been made, and others are projected, as, in addition to supplying energy for the operation of the railroads, the Swiss government expects to export a considerable amount of power, a limited quantity of which is now sold in northern Italy.

A good share of the financing and purchasing of supplies will be done in the United States. The proceeds of the Swiss loan of $25,000,000 offered here last July were used in connection with the program, about two-thirds of the amount having been spent in America for the purchase of electrical equipment and machinery and of raw material.

Further Swiss government financing in the American market to the extent of approximately $75,000,000 for the same purpose is anticipated in the next twelve or eighteen months. No definite arrangement has been made, although a financial operation involving the sale of $25,000,000 in bonds may be expected in the course of the next two or three months.

Consulting Engineers Take No Action on Joining Federation

AT ITS annual meeting, held in New York on Jan. 17, the American Institute of Consulting Engineers, in accordance with the recommendations of the investigating committee, voted to take no action at this time toward joining the Federated American Engineering Societies. While the consulting engineers will remain independent for the present it will be their policy to co-operate with other engineering bodies, and the action does not preclude their affiliation with the Federation at some time in the future.

In a paper entitled "Engineering, Past and Future," by Col. George D. Snyder, the trend of engineering practice was reviewed, and among other things a large volume of engineering work along the lines of railroad electrification and hydro-electric development was predicted.

To fill vacancies occurring in the council Allen Hazen of New York, Morris Knowles of Pittsburgh and Charles W. Leavitt of New York were elected for the ensuing year.

Power Engineers Affiliate with New England N. E. L. A. Division

CLOSER relations with the New England Division of the National Electric Light Association have been established by the New England Association of Central Station Power Engineers, an organization which has intensively studied the problems of commercial power service in the Northeast for the last six years. At a meeting of the power engineers on Jan. 5 it was voted to become a standing committee of the Power Sales Bureau of the New England Division for the gathering and discussion of power sales data. This plan enables the organization of the power engineers' association to continue to function efficiently and avoids duplication of work within this geographical division of the N. E. L. A.

V. M. F. Tallman is chairman of the power engineers' organization and John West is chairman of the power sales bureau of the New England Division. It is expected that through the above affiliation the divisional membership of the N. E. L. A. will share the benefits and participate in the work of the power engineers' association through the distribution and analysis of data and papers from time to time in advance of the divisional conventions.

October's Energy Output 100,000,000 Kw.-Hr. Ahead of September's

FIGURES of electrical generation by public utilities for the month of October have just been issued by the United States Geological Survey. They show a total of 3,733,304,000 kw.-hr. as compared with 3,624,279,000 kw.-hr. for September. Hydro-electric generation was 21,000,000 kw.-hr. ahead of September, the October figure being 1,337,079,000 kw.-hr. Unlike the central-station statistics published monthly by the ELECTRICAL WORLD, the figures of the Geological Survey include electric railways.

Average daily production of electricity in kilowatt-hours by public utility plants for the first ten months of the year was as follows: January, 124,700,000; February, 119,800,000; March 120,700,000; April, 119,100,000; May, 115,600,000; June, 118,800,000; July, 116,800,000; August, 119,500,000; September, 120,800,000 and October, 120,400,000. The total output for the ten-month period from January to October, 1920, was 36,484,000,000 kw.-hr., an increase of 15.8 per cent over 1919.

The output for October, 1920, involved the consumption of more than 3,160,000 tons of coal, more than 1,150,000 barrels of fuel oil and 2,370,000,000 cu.ft. of gas.

Central Maine Power Acquires More Properties

PERMISSION has been granted to the Central Maine Power Company by the Maine Public Utilities Commission to take over and consolidate with its organization eight electric light and power companies, with a combined capitalization of more than $2,000,000. The companies to be merged are the Hartland Electric Light & Power Company, Newport Light & Power Company, Union Light & Power Company, Waldoboro Water, Electric Light & Power Company, Solon Electric Light Company, Wiscasset Electric Light & Power Company, Brunswick & Bath Light & Power Company and the Penobscot Bay Electric Company, with exception of the gas plant of the last-noted organization at Belfast.

About six months ago the Central Maine secured a majority interest in the public utilities controlled by W. S. Bird and H. J. Chisholm. These included the Oxford Electric Company, the Knox County Electric Company, and an interurban trolley property.

Boston Jobbers Co-operate for Home Beautiful Exposition

LEADING electrical supply jobbers at Boston have agreed to occupy a centralized space at a "Home Beautiful" exposition to be held in the Mechanics' Building in that city, April 16 to 30, under the direction of Chester I. Campbell, and about $8,000 has been appropriated to make the electrical side of the show a success. The purpose of the exhibition will be to encourage the use of improved furnishings and devices in the home. No electrical products will be sold at retail, but all jobbers exhibiting will direct inquiries to proper retail channels. The electrical display will be one of the best ever staged in Boston. At a meeting last week in the office of F. S. Price, president Pettingell-Andrews Company, Boston, Miss Lola Fisher, leading lady of the "Honors Are Even" company, then playing in Boston, drew by lot the space location for the jobbers' exhibits, which proved to be one of the best in the hall.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Technical Advertising to Be Taught at Ames.—Courses in technical advertising arranged especially for engineering students are being offered by the Iowa State College at Ames. The aim is to prepare engineering students to take hold of advertising problems in the technical field.

Telephony in Sweden.—In Sweden, which has the reputation of being from a telephonic point of view the best developed country in Europe, a 200-pair cable similar to that which runs from New York City to Buffalo is about to be installed by the Western Electric Company, which has sent three of its cable experts to the Scandinavian kingdom to direct the work. The cable will run from Stockholm on the east coast to Gothenburg on the west coast, a distance of about 400 miles, and will pass through five or six large towns. It will have full repeater equipment.

Hydro-Electric Progress in New Zealand.—The extensive hydro-electric program on which the government of New Zealand purposes to spend about £20,000,000 for generating plants and transmission lines is beginning to get under way. The government already has a big station in operation at Lake Coleridge, which has proved a financial success, and preliminary work has been done on another great station to be built at Manganhoe, near Wellington. This is intended as the first section of a complete system of transmission lines in the North Island. Only 500,000 hp., however, is estimated to be available in this island as compared with nearly twenty times as much in the South Island.

An Unusual Report to a State Commission.—The following "return" was sent to one of the New England public utility commissions, written in pencil on ruled letter paper by the owner of a small public service plant: "Public Utility Commis. Dear Sir: Find inclosed Rates charged for Electric Light Current used by what few people there are on my Circuit: 15c. Pr. Killerwot, $12 a year for Street Lights and there is 18 of those. Operating expenses for Last year, $650.00 and amt. of current used $650,00. I don't run this plant for a business as I have a General Store and am Postmaster, also run Picture Show here, so you see I have to have light, and I have taken on a few other to help Pay running Expenses. There are 20 Houses and Stores on Circuit beside my own. Yours Truly, —— ——. P. S. There is no Company to it and have never bin Incorporated."

Eliminating the Question Asker.—"While the field for the larger electric signs has been very successfully covered," the *Edison Monthly* remarks, "resulting in the use of these signs for almost every purpose where signs are required, the field for the small electric sign for interior use has only just started to be developed." In hotels, railway stations, theaters and public buildings of all kinds these signs are being multiplied. Uniting the two most desirable features of a directional sign, conspicuousness and ornament, their advantages, more especially in dark corners, over painted signs are indisputable. A statistician might find employment in estimating how many million questions and answers they cause to remain unspoken in the course of a week or a year.

Advertising the Public Service Commission.—The Public Utilities Commission of Idaho has issued an order requiring every public utility operating in that state to post notices to be furnished by the commission reading as follows: "Notice to the Public.—The Public Utilities Commission has jurisdiction over (1) boat, (2) electric power, (3) express, (4) gas, (5) railroad, (6) sleeping-car, (7) street-railroad, (8) telegraph, (9) telephone, (10) water, (11) warehouse, (12) wharf, rates, service and regulations, except those of cities and villages and mutual companies. If you have any question, complaint or suggestion as to any rate or fare charged, or as to the kind or adequacy of any service furnished, or as to the scope or effect of any regulation or rule, please inform the commission. We can help you only when we know your needs. Address, telephone or call on Public Utilities Commission, Boise, Idaho."

Hydro-Electric Project at Elephant Butte Dam.—A scheme is on foot to bring about the production of 33,000 hp. in electrical energy by the construction of three power plants on the Rio Grande—one at the Elephant Butte Dam, one at Tortugas and one at Canutillo. These plants, according to the promoters of the project, can be built for $4,000,000, will pay for themselves in less than ten years and thereafter will produce a net revenue exceeding $500,000 a year. The Elephant Butte Dam was completed under the auspices of the United States Reclamation Service in 1916 at a cost of $10,000,000 and has provided irrigation for approximately 80,000 acres of land. The proposal now submitted to the Reclamation Service is that if the United States will build a canal designed to double the present extent of the irrigation district, the farmers of the territory to be developed, in New Mexico and Texas, will finance and build the power system and furnish power to the government for the purposes of the project at cost. The city of El Paso will extend the canal to its boundaries and pay for its share of the benefits to be derived from carrying out the plan described.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Recent Institute Meetings.—On Monday last, Jan. 17, the Vancouver (B. C.) Section, A. I. E. E., listened to a paper by E. E. Walker on "Electrical Energy Rates." The speaker at the Pittsfield (Mass.) Section meeting on Thursday evening last, Jan. 20, was B. R. Baumgardt, whose topic was "On the Frontiers of the Universe, or an Evening with the Stars."

Coming Institute Meetings.—The subject of the meeting of the Chicago Section, A. I. E. E., to be held on Monday next, Jan. 24, will be "Research, a National Issue and How to Meet It in a Practical Way." On Feb. 28 this section will discuss "Dependence of Aërial Transport on Electricity." The Portland (Ore.) Section will meet on Monday, Feb. 7, when George Meyers will give an address on "Public Utility Financing."

St. Louis Section, A. I. E. E.—This section has elected as officers for the year 1921 J. L. Woodruff of the Century Electric Company as chairman and Walter H. Millan of the Union Electric Light & Power Company as secretary. The chairmen of the principal committees are: C. C. Robinson, meetings and papers; Stanley Stokes, membership, and C. H. Lankford, entertainment. Members of the section intend to nominate H. W. Eales, chief electrical engineer of the Union Electric Light & Power Company, for vice-president of their district.

Coming Meetings of Electrical and Other Technical Societies

Western Association of Electrical Inspectors—Detroit, Jan. 25-27. (For program see issue of Jan. 1, page 58.)

American Institute of Electrical Engineers—Chicago Section, Jan. 24; Portland (Ore.) Section, Feb. 7.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 27 and 28.

Association of Iron and Steel Electrical Engineers—Birmingham Section, Jan. 27; Philadelphia Section, Feb. 5; Cleveland Section, Feb. 14.

Indiana Engineering Society—Indianapolis, Jan. 27 and 28. (For program see issue of Jan. 15, page 168.)

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—New York, Jan. 28.

Institute of Radio Engineers—New York, Feb. 2.

Florida Engineering Society — Lakeland, Fla., Feb. 7 and 8.

A. I. E. E., A. S. M. E. and A. S. C. E. (joint meeting)—Boston, Feb. 8.

New Mexico Electrical Association—Albuquerque, Feb. 14 and 15.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 14-17.

A. I. E. E.—Midwinter convention, New York, Feb. 16-18. (For program see issue of Jan. 8, page 111.)

American Physical Society—New York, Feb. 25 and 26.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Inefficient Operation.—Necessity for an electric plant to shut down a part of its service in order to furnish required energy for another service division can only be the result of inefficient operation, in the opinion of the North Dakota Board of Railroad Commissioners, where the plant is made up of two generating units rated at 75 kw. and 50 kw. and the highest load ever reached was 75 kw. and the average peak not more than 50 kw. or 60 kw.

Discontinuance of Steam-Heating Service Without Sufficient Notice Prohibited.—The Winona Electric Light & Water Company having asked permission to increase its rates for steam heating or else to abandon its heating service, the Indiana Public Service Commission ordered the service continued and the rates increased, declaring that inasmuch as the application had not been filed until the middle of August and the hearing was approximately thirty days thereafter it was not only difficult and expensive but in some cases would be impossible for customers to substitute individual heating plants before cold weather.

Where Electric Heating Service Is Discriminating.—In denying a petition from the Idaho Power Company to make a change in the application of rate schedules applied to domestic and commercial air and water heating the Idaho Public Utilities Commission asserted that the continuation of electric heating service would be discriminatory if the installation required to carry the heat load were demanded by other types of service and the heating service could not, because of its cost, be supplied at less than a prohibitory rate. An increase in electric heating rates was held to be equitable where the service was originally offered and accepted in competition with coal and the cost of coal had greatly increased since that time.

Cost of Fuel Affects Rate Fixing in North Dakota.—The North Dakota Board of Railroad Commissioners recently granted substantial increases in electric rates to the Union Light & Power Company at Fargo, the Red River Power Company at Grand Forks and the Northern States Power Company at Minot. In handing down its decision in the first-mentioned case, which has been reversed by the District Court and the case appealed to the Supreme Court, the commission said: "The commission appreciates and approves the purpose of this company of endeavoring to make a saving by securing at present prices the coal it shall require for the ensuing nine months. While it is not inclined to grant surcharges as a general principle, it is fully of the opinion that the emergency condition presented by this case is such as to require immediate action. The commission is in favor of the application of a surcharge inasmuch as it is disinclined at this time to make any change in the rate structure and steps on the present existing rates. The commission requires that the company exercise the best judgment possible in the purchase of its coal, that it profit at all times and whenever possible by adequate coal for its purposes at the lowest possible cost, and that it use every effort possible to secure its required fuel as near the point of consumption as possible in order to effect a saving in the freight charges."

Thirty per Cent Surcharge to Cover Transition Period of Municipal Plant.—The city of Oconomowac, Wis., having decided to abandon the operation of its steam-electric generating plant and to purchase all its electrical energy from a high-tension transmission line in the neighborhood, applied recently to the Wisconsin Railroad Commission for authority to increase its rates 30 per cent during the period that will elapse before the change can be completed, after which rates will once more be adjusted. According to the operating statement for the six months ended Aug. 31, 1920, as adjusted by the commission, the city had suffered a deficit of $3,281 before taking into account any depreciation charges or tax assessments. The commission on the showing granted the requested temporary surcharge, allowing it to be applied to minimum as well as to all other bills.

Municipal Plant Not Free from Need for Depreciation Reserve.—In granting to the city of Independence permission to raise its rates for electrical energy from 7 cents to 10 cents within and from 10 cents to 13 cents without the municipal boundaries, the Public Service Commission of Missouri took issue with the contention that a municipal plant does not need to have a depreciation fund. "The same necessity for a depreciation fund with which to make replacements exists with reference to a municipal plant as in a private plant," the commission declared, "and it is the practice to consider the necessity for such a reserve in fixing the rates of a municipal plant. It is a good business policy to treat a municipal plant as an enterprise separate and distinct from the municipality itself and to have accounts kept accordingly. If this policy is followed, the city should pay the utility at a reasonable rate for all service rendered the city, in order to avoid unjust discrimination in favor of the taxpayers of the city as against consumers. The utility, in turn, should pay the city a reasonable amount to cover local taxes and interest on the city's equity in the property, in order to avoid unjust discrimination in favor of the consumers as against the taxpayers."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Definition of "Proximate Cause."—"Proximate cause," declared the Court of Civil Appeals of Texas in a recent damage suit, "is that which in a natural and continuous sequence, unbroken by any new independent cause, produces the event, without which the event would not have occurred, it not being necessarily the cause which by measure of space or time stands next in proximity to the occurrence." (225 S. W. 421.)*

Utility Company May Sue to Establish Fair Rate.—Holding that the Public Service Commission has no power to make an order fixing a rate in excess of the statutory maximum, even though the statutory rate has been adjudged confiscatory and void, the New York Supreme Court (special term, Kings County) has also declared, in Morrell vs. Brooklyn Borough Gas Company, that under such circumstances the company may not resort to the common-law right of owners of public utilities within reasonable limits to fix their own prices for services rendered, but may bring an action in equity to establish a fair rate binding on public officers and consumers. It is an error to take the position that courts may determine that a rate is too low to be fair to the company or is too high to be fair to the consumer but cannot determine the rate that will be fair to both. (184 N. Y. S. 651.)

Climbing Decayed Pole Not Necessarily Negligent Act on Part of Lineman.—Failure of a lineman to examine a pole before climbing it does not necessarily constitute contributory negligence, that being a question for the jury, according to the decision of the Supreme Court of New Hampshire in Record vs. Manchester Traction, Light & Power Company. The company, appealing from a verdict for the plaintiff, had held that inspection of the poles had been turned over to the linemen generally, the company being thus absolved from responsibility for their condition. Evidence showed that it was the practice of the company to delegate linemen to inspect poles once a year, and the Supreme Court held that the lineman in the case under review had a right to assume the safety of the pole on which he was to work if it appeared sound and that the company was responsible for failure of the inspecting lineman previously to condemn the pole, as he should have done. (111 At. 629.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel, Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

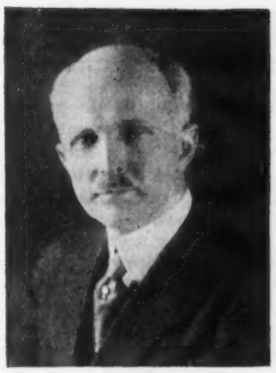
Homer Eldredge Niesz, by appointment of President Samuel Insull on Jan. 7, has become manager of industrial relations, in charge of the new industrial relations department of the

H. E. NIESZ

Commonwealth Edison Company, Chicago. Mr. Niesz is a member of that group of electric central-station men of the United States to whom the term "well known and well liked" may be truthfully applied. He was born at Canton, Ohio, and was graduated from Mount Union College in 1886. Soon afterward he went to Chicago and was engaged in electrical work as a wireman. In 1888 he became connected with the Chicago Edison Company, since succeeded by the Commonwealth Edison Company. For some years he was assistant superintendent of construction, and in 1899 he was advanced to be assistant to Louis A. Ferguson, then general superintendent and now vice-president of the company. On July 15, 1909, Mr. Niesz was made manager of the Cosmopolitan Electric Company of Chicago. Returning to the Commonwealth Edison Company in 1913, when the Cosmopolitan company was absorbed, he became secretary of the advisory committee and of the budget and expense committee. On April 1, 1919, he was appointed assistant to Vice-president Ferguson, a position he has now resigned to take up his new work. Mr. Niesz has been active and effective in many directions. He has been active in the National Electric Light Association for years, his memorable "question box" having been presented at the Denver convention of 1905. He was manager of the Chicago Electrical Show for several years and in 1911 was president of the Electric Club of Chicago. In 1913 he was chairman of the Chicago Section of the Electric Vehicle Association, and in 1914-1915 he served as reigning Jupiter of the Jovian Order, then a large, influential and prosperous national society of electrical men. Mr. Niesz is a member of a number of clubs and societies other than those mentioned, and he has written magazine articles relating to technical subjects and public utility problems. He is a man of ability and versatility, with a genius for friendship and conciliation which should stand him in good stead in the wide field of usefulness now opening before him.

W. L. Hillin, chief engineer of the Galveston (Tex.) Electric Company, has resigned and is now engaged in the automobile business at Navasota, Tex.

M. B. Wheeler, who recently resigned from the Dakota Gainaday Company of Sioux Falls, S. D., was from 1916 to 1920 associated with the American Utilities Company of Grand Rapids, Mich., being active as commercial agent with the company's largest subsidiary, the Wisconsin-Minnesota Light & Power Company, with general offices in Eau Claire, Wis. Prior to that time Mr. Wheeler was general sales manager of the Tel Electric Company of



M. B. WHEELER

Houston, Tex., and was prominent in electrical activities in the South. Mr. Wheeler is planning to enter the commercial side of electrical utility work. His address for the present is Hotel Carpenter, Sioux Falls, S. D.

W. G. Vincent, Jr., who has recently been promoted to the position of executive engineer of the Pacific Gas & Electric Company of San Francisco, will have charge of all studies made by the engineers of that company which pertain to the economic factors affecting its construction program, operation, valuation and rate making. Mr. Vincent was born in Louisiana in 1882 and was graduated from Tulane University, New Orleans, in 1902 and from Cornell University in 1904. He was first employed by the Telautograph Company to conduct its activities in San Francisco, resigning in 1905 to become assistant electrical engineer of the Ocean Shore

W. G. VINCENT, JR.

Railway of San Francisco. From 1907 to 1909 he engaged in consulting practice with Dean C. L. Cory of the University of California, and during 1909 and 1910 he was superintendent of the power and light works of the University of California. In 1911 and 1912 he was employed by the J. G. White Company as valuation engineer, being afterward transferred to the Pacific Gas & Electric Company as valuation engineer, a position he held until his recent preferment. Mr. Vincent has been very active in association work during the past few years and has just completed a term as chairman of the San Francisco Section of the American Institute of Electrical Engineers.

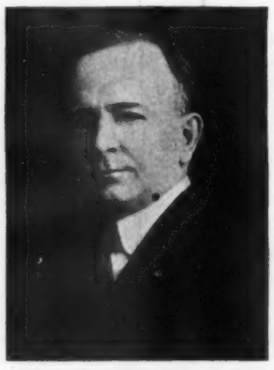
P. D. Gardner, formerly in charge of the new-business department of the Public Service Electric and Gas companies in Jersey City, N. J., has been appointed agent for the two companies at Bayonne, N. J.

E. A. Palmer has been appointed manager of the railway division of the San Francisco office of the Westinghouse Electric & Manufacturing Company.

William Baum, consulting industrial engineer with the Holeproof Hosiery Company, formerly in charge of the operating research bureau of the Milwaukee Electric Railway & Light Company, opened a consulting practice in Chicago on Jan. 3 as William Baum &

Company, industrial engineers. The firm will specialize in the development of industrial management systems and the betterment of industrial relations. Prior to Mr. Baum's connection with the Milwaukee Railway & Light Company he was for two years dean of the School of Engineering of Milwaukee and for thirteen years electrical engineer and European representative of the General Electric Company.

F. N. Averill, president of the Fobes Supply Company, electrical jobber with branches in Portland and Seattle, has been appointed chairman of the finance committee of the recently organized



F. N. AVERILL

Northwest Electrical Service League. Mr. Averill is well known in the Northwest owing to his active interest in association work. Recently he purchased for the Fobes Supply Company the Holabird Electrical Company, San Francisco.

Charles S. Voorhees, who has been associated with the sales organization of the Western Electric Company since November, 1895, has resigned as assistant telephone sales manager to assume the duties of general purchasing agent of the Western Union Telegraph Company. Mr. Voorhees entered the Western Electric organization as a boy in the cashier's office in New York. From that position he worked himself up through the switchboard and telephone sales departments into the executive department in 1908, when he became assistant telephone sales manager.

Garnet Blocksidge, railway department, Philadelphia office of the Westinghouse Electric & Manufacturing Company, has resigned to become sales engineer in the London office of the Westinghouse International Company. After graduation from the Virginia Polytechnic Institute in 1906, he joined the Westinghouse Electric & Manufacturing Company as a graduate student, remaining at East Pittsburgh until 1912, when he was transferred to the Baltimore office as salesman in the railway and light department. On Jan. 1, 1916, he was sent to Philadelphia.

E. W. Kendall, formerly in charge of the Boston office of Pass & Seymour, Inc., Solvay, N. Y., has been appointed general sales manager, succeeding F. S. Baldwin, who recently resigned. Mr. Kendall's experience covers the electrical contracting and jobbing fields. He was also associated with the Westinghouse Electric & Manufacturing Company in its Buffalo and Syracuse offices. Two years ago Mr. Kendall joined the sales organization of Pass & Seymour, Inc.

George C. Rough, president and director of the Packard Electric Company, Ltd., St. Catharines, Ontario, Can., having disposed of his interest, has resigned and terminated his connection with the company. Mr. Rough has been associated with the Packard Electric Company, Ltd., for nearly twenty years and worked himself up from salesman to chief executive. He will be remembered as a prominent Jovian, a member of several Jovian congresses and author of the French-Canadian dialect stories which appeared in the *Jovian Bulletin* before the war. He will soon leave on a business trip to Europe, and on his return will permanently locate in Montreal, where he will become actively engaged in electrical work.

Charles L. Cadle of Rochester, N. Y., has been appointed State Superintendent of Public Works by Governor Miller of New York State. Mr. Cadle is a graduate of the Case School of Applied Science, Cleveland. He is president of the Clark-Cadle-Harmon Manufacturing Company of Rochester, chief engineer of the New York State Railways, chief engineer of the New York & Harlem Railroad Company, first vice-president of the American Electric Railway Association, member of the Rochester Engineering Society and of the American Institute of Electrical Engineers.

F. S. Baldwin, who has retired as sales manager of Pass & Seymour, Solvay, N. Y., was recently tendered a farewell dinner by B. E. Salisbury, president of the company. At that time Mr. Baldwin was presented with a watch as a mark of the esteem in which he is held by his associates. E. W. Kendall, who has been manager of the Boston office of the company, succeeds Mr. Baldwin as sales manager.

Frank D. Fagan, who holds the position of vice-president and general manager of the Edison Storage Battery Company, came East from San Francisco last fall to take up those duties.

F. D. FAGAN

Mr. Fagan was born in California, and previous to his connection with the Edison Storage Battery Company he was manager of the lamp department of the General Electric Company. Mr. Fagan is well known on the Pacific Coast for his activities on various committees.

Obituary

Dr. William Robinson, inventor of the closed-track-circuit semaphore system for use on steam railroads, the coaster brake on bicycles and the Robinson radio truck used on trolley cars to enable them to get around curves and narrow switches, died Jan. 2 in Brooklyn, N. Y. Dr. Robinson was eighty years old. In 1878 he organized the Union Electric Signal Company, of which he was president, and later sold it to George Westinghouse. He was graduated from Wesleyan College in 1868 and at a later period received the degree of Ph.D. from Boston University.

George A. Cragin, formerly assistant general sales manager American Steel & Wire Company, Worcester, Mass., and general sales manager of the wire rope division of the National India Rubber Company, Bristol, R. I., died at Worcester on Jan. 3. He was born in Chicago fifty-seven years ago and was at one time president of the Electrical Manufacturers' Club.

Dr. Alexander Muirhead, a pioneer in telegraphic science, well known for work in connection with transmission, retransmission and reception on submarine cables, died in England on Dec. 13 at the age of seventy-two. He was born in Scotland and in early life did laboratory work under Dr. Matthiesen and work on electrical standards for Latimer Clark. In 1874 he carried out, in conjunction with the late Herbert Taylor, experiments to solve the problem of duplexing long submarine cables. They established the first ocean system of this kind between Ireland and Nova Scotia in 1878. About 1896 Dr. Muirhead became associated with Sir Oliver Lodge in developing the Lodge-Muirhead system of wireless telegraphy. He was a Fellow of the Royal Society.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Open versus Closed Shop Question Nearing Critical Stage

WHILE on the surface industrial conditions appear to be dull and quiet, there is an undercurrent of strife that has potential possibilities of becoming of tremendous national importance. The question of open shop versus closed shop is the point at issue.

There are other and equally important reasons for the coming strife besides the one just suggested. First, the greatest industrial employer, the United States Steel Corporation, refused to have anything but an open shop. This organization won out and in so doing made it apparent to other large employees that an open-shop plan was possible. Secondly, the courts have within the past few weeks taken from organized labor one of its most feared weapons—the secondary boycott.

Organized labor has sensed the situation and has called a meeting for Feb. 23 in Washington of representatives of 109 national and international unions affiliated with the American Federation of Labor "for the purpose of considering attacks now being made on the trade union movement."

An indication of how the manufacturers are lined up on the subject may be gained from the following resolutions, which were adopted last week in Chicago by a vote of 36 to 27 (half the assemblage voting) of the National Conference of State Manufacturers' Associations:

"It is recognized as fundamental in this country that all law-abiding citizens or residents have the right to work when they please, for whom they please and on whatever terms are mutually agreed upon between employee and employer and without interference or discrimination upon the part of others.

"We hereby express our purpose to support these fundamental principles of the American plan of employment by the maintenance of the open shop.

"We urge upon our members to secure by discussion and education the active support of workers, merchants, bankers and professional men and all other elements of their prospective communities in favor of American ideals and the open shop."

In the discussion as to the meaning of the open shop the definition given by A. J. Allen, secretary of the Associated Employers of Indianapolis, seemed to meet the general view. This was based on a definition given in "United States Bulletin 46" in the case of a coal miners' labor dispute a few years ago. According to this definition the open shop implies that it is the right of the laborer to enter into any wage contract with any employer without regard for any union and that he may work in any plant without the use of a union card or working permit.

Heavy Sales of Watt-Hour Meters

DEMAND for watt-hour meters has held up so strongly that consumers are being forced to enter the market as long as six months in advance of their immediate needs in order to insure delivery. The largest proportion of the buying, it is stated, comes from central stations. Manufacturers are gradually cutting down the number of their unfilled orders, it is true, for production capacity has been on the increase these past few months with better labor, raw material and shipping conditions. Then, too, the demand for watt-hour meters, while large at present, is naturally not so great during the winter season as it was some time ago. Stocks of the finished product, however, have not as yet and will not for some time start to accumulate.

Deliveries vary considerably according to the size of meter and the manufacturer. On single-phase watt-hour meters the best delivery that can be promised is six weeks, and deliveries range as long as twelve weeks. Polyphase meters are quoted from six to twenty weeks, and the direct-current type from five to ten weeks. Manufacturers are steadily increasing their production and these figures are expected to improve. One of the large producers that was turning out only 12,000 meters per week, and even considerably less than that last summer, is now producing at the rate of about 20,000 meters each week. The raw material supply is good and labor conditions are, of course, favorable.

Prices have held stationary since increases effective the early part of last May were made. Little likelihood of lower prices coming about very soon is seen as labor and material costs are reported to remain high. Optimism is the general keynote expressed regarding pospects for good sales in this line throughout 1921. If the building industry takes a boom commensurate with the need for housing that exists, meter sales will undoubtedly be heavy.

Brighter Market for Farm Plants Foreseen in Northwest

CERTAIN jobbers and dealers in the territory contiguous to Seattle and in Seattle are making optimistic statements regarding prospective sales of farm-lighting outfits. Up to date, sales have been light—much less than originally predicted—but it is believed that a change for the better will be manifested immediately.

The reason for this optimism is that the farmers in this section, sensing the futility of longer holding their produce, principally fruit, wheat and potatoes, have begun selling and already are making inquiries looking toward buying farm-lighting plants.

The various outfits have been well advertised during the past two years at the county and state fairs; the field work has been well done; nothing remains but signing the contracts for installation. Speaking as a whole, the jobbers and dealers are stocked sufficiently to meet all demands. Many jobbers, in an effort to stimulate sales, are guaranteeing against any price reduction prior to June 1.

Development of Japanese Market Expected by Summer

THAT Japan is in the market for electrical apparatus and supplies is well shown by the number of Japanese engineers who have been traveling through the United States during the past year, inspecting large hydro-electric stations and visiting manufacturing companies. Electric apparatus manufacturers and importers consider the market in that country with considerable optimism in view of the orders which have already been placed, and particularly because of several large propositions for hydro-electric development and railway electrification which are expected to break along in the middle of this year. A few of these have been held up temporarily. Specifications on these new propositions will probably be finished within the next few months, based on the data and findings of the visiting engineers to America.

It is understood to be the plan of the Japanese government to take over the operation of electrified railways and of central stations, although no final word has been received that this plan has been consummated. Consideration has been given it by governmental authorities. One of the plans embraces a hundred-million dollar corporation, one-half government, the other half private capital. At least the government is morally behind the electrical development of the country.

Improvement has been noted in the financial condition of the country. Electrical exporters and manufacturers have reported little difficulty in getting quick payment for goods shipped. Cash on bill of lading at the dock or a certain percentage with the order, more at the dock, further payment on receipt in Japan and final remittance when apparatus is in operation may be termed ruling methods of payment. There seems to be plenty of money in the banks in Japan, but comparatively little that can be pried away for developments. Conditions in this respect are not so different from those existing in the United States. The exchange rate is considered favorable.

Present Prices of Motors in Germany

FROM information just received from Germany it is interesting to note the prices for which electric motors are sold in that country. These are given in marks in the table below. A three-phase, 1,500-r.p.m. motor of 5-hp. capacity is quoted at 1,130 marks plus an addition of 550 per cent, which, at an exchange value of 2 cents per mark, would bring the figure to $146.90. A 30-hp. motor, same rating, at 3,600 marks, would be valued at $504. From the speed given these motors undoubtedly are for 50 cycles, while the American standard is 60 cycles. For purposes of comparison a 5-hp., 60-cycle, 1,800-r.p.m., three-phase, 220-volt motor of American make is being quoted at about $130, pulley and base included. Similarly, a 30-hp. motor, also without starter, is quoted around $340.

Horsepower	Revolutions	Price in Marks — Three-Phase	Price in Marks — Direct-Current	R.p.m.
0.5	1,500	290	485	....
1	1,500	440	620	....
2	1,500	520	920	....
3	1,500	640	1,010	....
4	1,500	1,010	1,140	1,800
5	1,500	1,130	1,430	1,500
10	1,500	1,820	2,320	1,300
15	1,500	2,320	3,150	950
20	1,500	2,800	3,640	900
30	1,500	3,600	5,270	850
40	1,500	4,400	....	....
50	1,500	5,000	....	....
60	1,500	5,800	....	....
75	1,500	6,840	....	....
100	1,500	8,480	....	....

To the above prices the following increase has to be added: Motors up to 20 hp., 550 per cent; motors, 20 hp. to 100 hp., 600 per cent.

Jobber May Be Manufacturer Under Excise Tax Change

IN REGULATION 47, just issued, the Bureau of Internal Revenue places certain constructions upon the meaning of "jobber" whereby jobbers may be put in the class of manufacturers for the purpose of the tax. Article 7 has been modified to provide that while a manufacturer is generally a person who actually makes a taxable article, or by the combination of two or more articles produces a taxable article, or by the combination of two or more articles produces a taxable article, under certain circumstances such a person is not a manufacturer for the purpose of the tax; but that if a dealer or jobber owns a patent, trademark, formula or recipe for a taxable article and contracts with another person or firm for the manufacture thereof, the contract specifying that the article can be manufactured only for such dealer or jobber and that it will be sold by such dealer or jobber as the manufacturer, the dealer or jobber is held to be the manufacturer for the purpose of the tax.

Furthermore, Article 34 has been revised to permit a manufacturer who is also a retailer to arrive at an average wholesale price, for purposes of fixing his tax on his retail sales, by taking his actual wholesale sales for a given month and using this average until such time as his records show a material change.

These changes affect certain jobbers of electrical supplies who sell their own trademarked articles and certain manufacturers who retail.

Fair Volume of Commercial Glassware Trade

A GOOD year ahead is seen by manufacturers of lighting glassware for commercial buildings. At the present time the larger mills are working full time, as a whole, although some of the smaller properties are closed down for a short time. There is always a regular volume of business coming through because of building changes and alterations, and right now there are quite a number of new constructions just coming into the lighting glassware stage. At the same time back orders are still running through the mills in fair volume.

The pressure is off the buying at this time, it is true, and the mills can begin to make shipment in two and three weeks, depending on the amount of special finish required on the glassware.

There is plenty of labor available, and raw materials provide no delay in production. The only exception reported is the shortage of natural gas in certain Mid-Eastern states, necessitating rationing for industrial use. German clay is again on the market for use in making the melting pots, the breaking of which when domestic clay had to be used caused needless expense and delay.

Foreign business is quiet, but is still holding up to some extent.

Metal Market Situation

A LITTLE better tone is noticeable in the copper market, such that producers hesitate to quote spot delivery under 13¼ cents a pound. For February, March and April their prices are from 13¼ to 13½ cents. Some sales were recently made for first-quarter delivery at 13¼ to 13⅜ cents. At the same time producers are unwilling to sell to any but consumers, and the outside market is very desirous of getting the metal.

The demand from domestic sources has improved, and along with it have come some sales to Europe.

According to the United States Geological Survey, exports of refined copper for 1920 amounted to 610,000,000 lb., while there went into domestic consumption 910,000,000 lb. To these estimates the Survey adds that of refined copper stocks on Jan. 1, 1921, as 684,000,000 lb.

Lead is holding a strong market. Buying was active a week ago, but it is somewhat off now. With the official price at 4.75 cents in New York, the outside market is holding for 5.10 to 5.20 for prompt, and a good deal of the business is going on among these buyers.

NEW YORK METAL MARKET PRICES

	Jan. 10, 1921	Jan. 18, 1921
Copper	£ s d	£ s d
London, standard spot	74 0 0	70 7 6
	Cents per Pound	Cents per Pound
Prime Lake	13.75	13.75
Electrolytic	13.00–13.25	13.00–13.12½
Casting	12.75	12.75
Wire base	16.25	15.75
Lead, trust price	4.75	4.75
Antimony	5.15	5.10
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	11.50	11.50
Zinc, spot	6.00	5.95
Tin	38.75–39.00	35.00
Aluminum, 98 to 99 per cent.	28.30	22.50–23.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.00–10.75	11.00–11.25
Brass, heavy	6.00– 6.50	6.00– 6.50
Brass, light	4.00– 4.50	4.00– 4.50
Lead, heavy	3.50– 3.75	3.75– 4.00
Zinc, old scrap	3.00– 3.25	3.00– 3.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

IN CERTAIN parts of the country, as reported from Atlanta, Boston and Chicago, there is a little better inquiry in the jobbing field and to a small extent better buying, but in general the electrical trade is quiet. Conditions are reflected in the labor situation, the number of men being released increasing as the weeks go by. It has been found necessary for the largest electrical manufacturer to cut his forces about 10 per cent because of decreasing business. Other producers have been cutting forces or reducing wages to a limited extent. At the same time, there is more activity in the textile field, and this has caused better inquiry in the industrial lighting and in the motor markets.

Prices continue on a downward trend, easier quotations having been reported on rubber-covered wire, loom, conduit, flexible armored conductor and insulation; at the same time no radical changes have been announced. Stocks are being kept only up to day-by-day demand, and this is done with ease except in the case of porcelain ware; conduit is better and sufficient for current needs.

No better collections are reported, and in some cases they are not all that could be desired. From the Northwest is reported the liquidation of some of the smaller electrical dealers because of decreasing prices and light trade.

NEW YORK

Spasmodic buying in an otherwise listless market characterizes the trade at present. Prices in some instances seem to be touching bottom, but there is no inclination to increase stocks and both jobbers and dealers are keeping their purchases down to the narrowest margin of current requirements. Shading of prices to stimulate sales is not uncommon, especially in the case of those stocks which are long.

Noticeable activity in the demand for industrial lighting fixtures has appeared, which is attributed to the textile industries resuming operations. There is a general impression that other industries are coming into the market, particularly for maintenance supplies, indicating that manufacturing activity is opening up.

While there is a considerable amount of building in the electrical stage the demand for wiring supplies is negligible, and as might be expected at this time little new construction is being started. Stocks of all materials, with the exception of porcelain, are plentiful for the present demand and prices are soft. Should there be a renewal of building operations it is predicted in several quarters that there would be a sudden upturn in prices with a considerable shortage along some lines. Collections have shown no improvement, and up to ninety and 120 days have been reported in some cases, although sixty to ninety is nearer representative.

Conduit.—Manufacturers' price reductions were reflected in jobbers' prices this week. Quotations on ½-in. black pipe ranged from $70 to $79 per 1,000 ft. and $85 in small lots. Prices vary considerably, depending on the stock to be moved. Demand continues small, with a plentiful supply of all sizes.

Rubber-Covered Wire.—There is little or no demand for the large stocks which are being carried and prices are unsteady. On No. 14 in 10,000-ft. quantities quotations can be had from $7.50 to $8.50 per 1,000 ft.

Flexible Armored Conductor.—This market was broken last week owing to unloading of surplus stocks. Nominal quotations by jobbers are from $62 to $65 per 1,000 ft. for No. 14 two-wire, although a price slightly under $60 has been reported. Stocks are long, with demand from slight to nothing.

Heating Appliances.—Price reductions by manufacturers as reported became effective on Jan. 15. Demand has shown no increase, and there is a tendency on the part of dealers to mark time. Stocks are ample, and buying is in small quantities to meet immediate requirements.

Heaters.—Jobbers report long stocks with light demand on account of open winter. Present indications are that there will be a considerable quantity carried over.

Weatherproof Wire.—Prices are nearly uniform, leading jobbers quoting a base price of 21 to 22 cents. Stocks are ample, but sales are light as requirements along this line are small in this section.

Outlet Boxes.—Prices remain unchanged and stocks are comparatively low. Supply about equals demand, and no surplus is reported.

Non-Metallic Flexible Conduit.—Stocks are ample, but demand is always small. Nominal quotations range from $22 to $27.50 per 1,000 ft. for the ⅜-in. size.

Vacuum Cleaners.—No change in price has been reported in this line and sales are slow. Jobbers' stocks are long and dealers are inclined to await developments.

Washing Machines.—Sales are light all along the line, and stocks are kept at a minimum. No change has been noted in prices.

CHICAGO

Increased activity, mentioned last week as being confined largely to inquiry, is still thus limited. The volume of inquiries being received by most jobbers is quite large and is spread over the entire range of electrical goods. Most interest is shown in inside wire, schedule material and residence fixtures.

Architects throughout the district report that many clients are asking for estimates on proposed residences and small flat buildings. Prospective builders are now shopping to find if the recent widely heralded price reductions in all lines are so distributed as to justify their proceeding with building plans. Unfortunately, most of this shopping results in a decision to wait a while longer, for in spite of radical cuts in lumber building cost is still very high.

Retail trade is active in that many clearances are under way. No price cutting is in evidence, particularly on standard lines. Jobbers report that few orders outside of routine replacements are being received from dealers. No price changes have been reported in the manufacturing or jobbing end of the business.

Motors.—Stocks are still spotty, but most sizes are readily obtainable. Sales are at a low figure and inquiry on this line is only fair.

Meters.—Deliveries remain some weeks behind orders, and from the volume of inquiries it is thought that this condition will continue indefinitely. Central stations are unable to obtain meters in sufficient quantities to supply their needs, and the building up of stocks by jobbers is out of the question.

Transformers.—Some improvement in sales of transformers for farm-line equipment is expected, and some inquiry has been noted in the past few weeks. Prices are firm, and with the establishment of the idea that no radical reduction can be expected good business should result. Deliveries are quoted from ten to fifteen weeks.

Safety Switches.—Supply is getting easier, most suppliers being able to fill orders from stock or on short notice. Demand remains about normal, with no indications of a change in conditions.

Locknuts, Washers, Bushings.—Many inquiries are being received on this class of material, but few actual orders are placed. In most cases stocks are in excellent shape. In general prices are firm at old levels.

Knobs and Tubes.—Production remains on a low scale compared with the needs of the market. Owing to the light

sales of the past few weeks jobbers are being enabled to build up stocks, but in most cases they are not yet what they should be. Prices are unchanged.

Household Appliances.—Electrical goods remain in fair demand, with no price shading in evidence. Makers and distributors of washing machines report the week's business as good. Considerable sales effort is being made with encouraging results. The feeling throughout the industry here is that prices are going to remain where they are.

BOSTON

Little change has occurred during the past week in trade conditions, but sentiment is a bit more hopeful. Small orders are increasing somewhat. Building and engineering contracts in New England for the week ended Jan. 11 totaled $2,715,600, a gain of $50,000 over the preceding week. Wage difficulties at Boston present an unstable situation, with a threatened protracted slow-down of building operations, which may, however, be averted at the last moment. Contractor-dealers are buying little from the jobbers, but orders from large industrial plants are coming in fairly well. A moderate amount of central-station purchasing is reported, but as a whole the war-time policy continues. Prices are holding up firmly.

Collections are giving distributers some trouble, but the situation is not alarming where active follow-up work has been done. Stocks are over full in many cases, but in others the bins have been allowed to dwindle so much that considerable hand-to-mouth buying with small order shipments by mail is in evidence. Price guaranteeing has clearly stimulated some trade.

Wire. — Stocks are easily meeting current demands. Rubber-covered No. 14 sells for $8.50 per 1,000 ft. in 10,000-ft. lots. Weatherproof base holds at 20 cents and bare base at 18 cents.

Non-Metallic Flexible Conduit.—Sales were made at the rate of $22.50 per 1,000 ft. in the ⅜-in. size early in the week. Not much ½-in. was moving but the Boston price Monday was $25 per 1,000 ft. Stocks are plentiful and demand is easy.

Tape.—A little friction tape is moving around 50 to 52 cents per pound in 100-lb. lots, ¾-in. black. Compound is quoted about the same.

Sockets.—In case lots pulls are selling at 48 cents net, keys at 27 cents and keyless at 26 cents. It is reported that the 250-unit standard package of ½-in. cap pulls has been restored after a few days' trial of the 500-unit package. The convenience of the smaller package was undoubtedly a factor in this change.

Knobs and Tubes.—This material is in quiet demand without further price changes. "Nail-its" are selling at $27 per 1,000 in barrel lots and 3-in. tubes are moving sluggishly at $11.35 per 1,000. No trouble in getting porcelain supplies has been reported of late, with the exception of insulators.

Insulators. — Porcelain insulators are very scarce, one large house being cleaned out on Monday. Glass insulators are far from plentiful, but were selling early in the week at 15 cents net in barrel lots, 600-volt rating.

Rigid Conduit.—Well-rounded stocks now exist. There is an occasional break in sizes, but deliveries are excellent in relation to the present moderate demand.

Radiators.—Jobbers and retailers are well stocked; trade is a little quiet, barring a fair amount of staple business.

ATLANTA

Reports from jobbers indicate that the end of the holiday season brought with it a noticeable revival in their line of business, orders being received consistently, primarily for materials for current needs. There is also a fair volume of orders to replace depleted stocks. The latter class is showing a slow but continued increase. While construction in the section as a whole is at a low ebb building in Atlanta is on the increase, quite a healthy volume of construction, both of the residential and commercial type being proposed and under way. The strike of the building trades mentioned last week has served to check construction on one or two of the larger buildings, but has not interfered with activities as a whole. Quite a number of inquiries for transmission-line material in large quantities are being received, several of the inquiries being for high-tension construction. Hesitancy is to be noted in the placing of heavy orders, as there seems to be a feeling that prices in general will shortly reach a lower plane.

The credit situation, especially in the rural districts, seems to be on the road to permanent improvement, even though farmers as a rule are loath to release their cotton at the present low price of 14¾ cents. The movement of cotton, however, is in excess of what it has been for some weeks past.

Meters.—Manufacturers have not been able to fill all back orders, and some difficulty is reported in obtaining instruments of the popular sizes in sufficient quantities for immediate needs. Practically no stocks are on hand and shipments continue to be quite long.

Wire.—Orders are being placed in greater volume, thus reflecting the opinion that wire prices have reached their low ebb. Sizes of from No. 14 to No. 40 are moving fairly well, with rubber-covered on 18-cent base and weatherproof on 23-cent base.

Conduit.—No heavy stocks have been accumulated; in fact stocks of the popular sizes continue to be somewhat spotty. Prices are down approximately 12 per cent, quotations on lots of 2,500 lb. being: Galvanized, ½-in., $8.49; 1-in., $16.66; 2-in., $36.27.

Heating Devices.—Socket heating devices continue to hold up unusually well for this period of the year, flatirons being as usual the best seller. Stocks, with the exception of hollow ware, are in excellent shape. No reductions in prices have as yet been reported.

Air Heaters.—The recent cold snap has stimulated the sale of these heaters, and retailers report that this winter will undoubtedly make a record in the volume of sales. Local stocks are in good shape.

Electric Ranges.—One of the largest jobbers reports quite a movement in this line, most of the shipments going to Florida territory. The high price of fuel undoubtedly accounts for the demand being so well sustained. Local stocks are in excellent condition.

ST. LOUIS

Another quiet week has been passed by local jobbers and manufacturers, though reports from some sources place the amount of orders billed and new orders received as ahead of that of the previous week At the present rate the volume of business for January will be behind that of December and from 15 per cent to 25 per cent below that of January, 1920. Caution seems to be the watchword on every hand, and though much confidence is expressed in the future there are very few who are willing to place orders or come back to normal production at present.

That production has decreased materially here is shown by the Department of Labor survey just completed, which estimates the number of unemployed in St. Louis as 40,000. The electrical industry is not so seriously affected as some others. Two large motor manufacturers have just completed additions to their plants, and their production has been curtailed very little. Transformer factories are operating at about normal capacity. Taken as a whole, it is estimated that electrical production locally has shrunk from 10 to 20 per cent.

Local power sales are reported to have shown a slight decrease due to the decreased industrial activity. Local jobbers report the same condition prevailing generally among their utility customers in the St. Louis trade territory. In spite of this the utilities are proving the most consistent buyers, though they buy usually for immediate needs only. Sales to industrials have been low for some time. Contractors are still doing a fair amount of work, but their needs have been cut also. The collection situation has not become any worse during the past week, seventy days being a good average. Talk is heard of money becoming easier, but this has not been reflected in collections.

Poles.—Demand is characterized as fair to good, with much of the buying coming from the railroads and a smaller percentage from central stations and telephone companies. Practically all jobbers have complete stocks of all sizes and can make immediate deliveries on large quantities.

Line Hardware.—Stocks are all good. Demand is not quite so good as it is for poles, but stocks are moving.

Motors.—Jobbers report a good movement of popular sizes and report also that they have more complete stocks of those sizes now. By shopping around buyers now can get whatever size and type they want in any reasonable quantity. There is very little movement of fractional motors.

Lamps.—Lamps are moving well, though the demand is not up to that of last year. Lamps for street lighting are moving steadily. Stocks are very complete.

Wire.—Rubber-covered No. 14 is being quoted around $8.75 per 1,000 ft. with small demand. There are very few prices below this. Weatherproof is being quoted on a 17.5-cent base.

Fixtures.—The volume of orders for special designs continues to overshadow the call for standard lighting units.

Lamp Cord.—Jobbers have large stocks of both the silk and cotton cord. Movement of both is slow.

Guy Wire.—The shortage of guy wire seems to have been alleviated recently, some jobbers reporting an ability to get immediate delivery on all they want. There is a fairly good demand from central stations, whose needs for this item went unfilled during the fall.

SALT LAKE CITY—DENVER

A co-operative drive to stimulate the householders' interest in more electrical outlets is now on in the jobbing centers of the Intermountain district. The impetus for the campaign came from the Pacific Coast, where co-operative work of this kind has proved signally successful. The plan at present is to use the direct-by-mail appeal to the housewife and later to extend the scope on publicity work.

Consumer buying has not increased in volume to an appreciable extent, although most dealers are hopeful of improvement in the market in the near future. Liberal time-payment contracts are now the rule. A representative dealer reported that his 1920 business was on a 25 per cent cash basis. Persistence in making collections is therefore a vital part of every merchant's business operations.

Heater Cord.—Consumer demand is steady and satisfactory, No. 16 retailing at 25 cents a foot. There is no trouble in keeping stocked.

Lamp Cord.—Demand is good and stocks are plentiful, No. 18 cord selling at 5 cents a foot.

Toaster Stoves and Grills.—Not much consumer interest is being manifested. Jobbers and dealers report stocks ample.

Bell Transformers.—Dealers that push the line report many installations for doorbell service. Standard types, installed, cost about $5.

Two-Way Plugs.—The demand is large and constant and orders are filled quickly.

Key Sockets.—These are not moving well during the period of inactivity in building. Retail price is 65 cents.

Motors.—There is little activity and jobbers are prepared to meet demand. Dealers are not disposed to stock heavily.

SAN FRANCISCO

The rainfall that has extended pretty generally over the state has continued the good wetting that should make 1921 a banner year for crops. A heavy snowfall on the Sierras is reported.

The tens of thousands of extra horsepower soon to be marketed by the Great Western Power Company and later in the year by the Pacific Gas & Electric Company will be the cause of energetic campaigns for its distribution. First of all must be served the irrigated districts and districts not previously reached through shortage of power. Such is the case in Kern County, where the San Joaquin Light & Power Corporation is reaching out to districts newly planted with cotton.

An instance where building is so necessary that it must be carried out may be noted in a new project reported from Santa Barbara, where it is proposed to construct about 200 homes at an average cost of $5,000 each.

Wire and Cable.—Telephone wire in the No. 19 size, commercial grade, is selling for $13.10 per 1,000 ft. in 5,000-ft. lots. The No. 18 size, 100 megohms, which is approved by the telephone company for use on concealed circuits connected to its system, is selling for $22.30 per 1,000 ft. with a 5 per cent advance over this 5,000-ft. price for 1,000-ft. quantities. These prices have been fairly steady, barring slight adjustments, for several months. No. 14 solid, single-braid, rubber-covered wire is now selling for $10.25 per 1,000 ft. in coil lots or $9.75 per 1,000 ft. in 5,000-ft. lots assorted with other sizes. Local stocks are very good but not alarmingly heavy.

Boxes and Covers.—Standard package prices are now list prices for galvanized with a further 5 per cent for black finish. These prices have been generally effective since last September, despite recent conduit decreases of 5 per cent and a drop of 12½ per cent on bushings and locknuts.

Batteries.—After a period of stagnation, because the automobile business was the first of the big industries to be affected by the pinch of retrenchment, the storage-battery market has been marked by recent sharp decreases.

SEATTLE—PORTLAND

With inventories which, because of price declines, have required more than ordinary care and thought out of the way, the electrical industry has turned to the task of getting new business in a more cheerful frame of mind and with rather better results than might naturally be expected. In other business and in financial lines there is also manifested a more cheerful feeling now that sales to establish losses have been made and covered. Both jobbers and dealers in the Puget Sound district report that trade during the past week showed considerable improvement over the previous week, although the sales volume is still extremely light. Certain lines of electrical appliances have dropped in price and other types are expected to follow. With but few exceptions stocks are in excellent shape. The credit situation is very tight, but collections continue reasonably good. Reports from various sections in the Northwest show slight resumption of operation in lumber mills. Production is estimated at 66 per cent below normal as compared with 76 per cent for the second week in January.

There is a general feeling from manufacturers down that there will be a gradual price reduction during the next few months but that no radical changes will be made. Plans are being made for considerable business, which is expected to develop in the spring. Lumber mills throughout Oregon are opening up slowly. Some woolen mills are continuing operations at reduced wages, and wheat is beginning to move because farmers are hard pressed financially. Jobbers in Portland report business slack, about one-third that of early December. There is a continuous downward tendency in price of wire, and reductions are also noted in pole-line hardware of from 5 to 10 per cent and also in sockets. Stocks are reported far ahead of a year ago and are very uniform, nearly all lines being in good shape with the exception of insulators. The credit situation is very tight, with practically no loans being extended and collections exceedingly slow. There have already been some liquidations and probably will be more inside the next two or three months, those concerned being the smaller dealers who are unable to stand the strain of decreasing prices and poor trade.

In Portland vacuum cleaners and washing machines are not very active except for one or two types in general stock. The recent drop in washing machines has stimulated trade. Wire manufacturers will not accept future orders on any guaranteed price. Shipments have improved from six and eight months down to four and five months, but prices are unstable. Schedule-material stocks as well as shipments are improving in many lines, although stocks are somewhat spotty at the present time.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and Record of New Devices and Trade Literature

Hygrade Lamp Company Gets $50,000 Contract

A contract for about $50,000 worth of lamps has been secured by the Hygrade Lamp Company, Salem, Mass., covering the requirements of the Boston & Maine Railroad for about a year. The lamp company has just resumed operation on a two-thirds-time basis and reports that its 1920 business exceeded that of 1919 by about 50 per cent.

Wetmore-Savage Company Enlarging Quarters

The Wetmore-Savage Company, Boston, is enlarging its quarters to afford about 25 per cent more room, and to effect this has taken the entire building adjoining the offices of the company at 76 Pearl Street and is now remodeling one floor for increased office space. The total space occupied when this work is completed will be about 125,000 sq.ft.

New Miniature Lamp Packing Effects Economies

Following the adoption last summer by the Westinghouse Lamp Company of a new method of packing S-11 automobile headlight and spotlight miniature bulbs, it has definitely been determined that breakage has been greatly reduced. In applying this packing to candelabra lamps it is reported that breakage has dropped from a previous figure of about 30 per cent under the old method of packing to virtually nothing under the new.

The new method embraces the wrapping of each lamp in a separate corrugated paper and soft, tough paper package, with ten lamps to a carton instead of five. The Edison Lamp Works are about to use rather similar packing, tests on which show a saving of about 40 per cent in weight and about 60 per cent in space. It eliminates the use of excelsior and admits of making up an assortment of lamps easily and quickly. The flashlight, automobile side, instrument and tail-lamps will be placed in trays with holes opposite one another instead of staggered.

Waterwheel Manufacturer in New Quarters

James Leffel & Company have recently completed and occupied an entirely new factory and offices in Springfield, Ohio. The main factory is 75 ft. wide by 800 ft. long, from which extend the boiler shop, power plant, foundry, pattern shop, pattern storage, warehouse and garage. Concrete, steel and glass form the construction, while wood block floors are used on concrete foundation.

National Lamp Advertising for Half Year Issued

Following a plan similar to the one tried during the last half of 1920, the National Lamp Works has put out a "Right Book" outlining its advertising plans and features for the first six months of the present year. Formerly the company published each month a folder illustrating the month's advertising and dealer tie-ups. Postcards in the back of the book can be used for current helps.

Dodge Company Sells National Advertising to Employees

A variation in national advertising which the Dodge Manufacturing Company, Mishawaka, Ind., finds is working out with success is that of selling its national advertising to its workers by means of billboard displays. The underlying idea, of course, is to stimulate morale and pride of craftsmanship in the company's employees. The interest displayed by the men at plant No. 1, where the billboard was erected reproducing the double-page spread entitled "Faithful to All Industry," which appeared in a national publication last September, has convinced the Dodge company that its idea is fundamentally sound. The erection of other billboards at the various plants of the company is being planned.

Accused of Making Contracts Preventing Use of Competitors' Equipment

The Federal Trade Commission at Washington advises that, upon application for the issuance of complaint, the Federal Trade Commission has, as required by law, the public interest appearing, cited the Western Electric Company, Inc., New York City, in complaint of unfair competition in the sale of telephone equipment in interstate commerce.

This citation is for the use of "tying" contracts. By these contracts, which are made with the "Bell System" and with many independent telephone companies for the sale of equipment upon the condition that these companies will not use the equipment of any competitor of the Western Electric Company, it is alleged, the Western Electric has created for itself a monopoly in this line of commerce.

Further averment is that false statements are made to induce the making of the "tying" contracts and to procure the cancellation of contracts between competitiors of this respondent and independent telephone companies. Forty days are allowed in which to file answer, after which the case comes on for trial.

Wage Cut of 20 per Cent at Remy Works

The Remy Electric Division of the General Motors Corporation, Anderson, Ind., announced a general wage reduction of 20 per cent recently. The service department was the first one affected. It was reported at the factory office that fewer than 100 men were called back to work in the service department, that other departments will probably not resume operations before Feb. 1, and that a wage reduction of 20 per cent would apply to all departments. The Remy company was employing 1,000 persons when it shut down early in December. Two years ago the same plant employed more than 3,000 persons.

Waterwheel Maker Eliminates Union in Dealing with Men

Because of the action of 500 workers of the William Cramp & Sons Ship & Engine Building Company, Philadelphia, maker of the I. P. Morris hydraulic turbines, in going on strike on Dec. 22, announcement is made that the agreement of a year ago with the metal trades department of the American Federation of Labor has been discontinued. Consequently, it is stated, relations between employer and employee will no longer be carried on through a representative of the union, but by direct intercourse.

General Electric Finds Cut in Force Necessary

With a payroll reported to be the highest in its history, and with bookings of new business at a rate of about $200,000,000 at this time, while early in 1920 they were at the rate of about $350,000,000, it is not surprising to learn that the General Electric Company finds it expedient to make reductions of about 10 per cent in the working force in the factory departments of its various apparatus and supply plants. At the same time there is a sufficiently large volume of back orders to keep the plants working for several months.

Maker of A B C Laundry Equipment Issues $550,000 Bonds

An issue of $550,000 in first mortgage 8 per cent sinking-fund ten-year convertible gold bonds is being offered by Altofer Brothers, Peoria, Ill., maker of the A B C electric clothes washers, wringers and ironers. They are dated Nov. 1, 1920, and are in denominations

of $100, $500 and $1,000, redeemable at 110 and interest on semi-annual interest dates during 1921, or on any subsequent interest dates, the premium to be reduced 1 per cent of par from 110 for each year elapsing thereafter. The present plant includes seventeen acres of land with about 165,000 sq.ft. total floor space in its manufacturing buildings. Net tangible assets are given as $3,129 for each $1,000 bond.

Record Foreign Cable Order Going to Sweden

In the manufacture of the cable which the Western Electric Company is now shipping to Sweden there is required 6,500,000 lb. of lead and 3,350,000 lb. of copper. The first installment of this cable is in transit, and when the total amount of 320 miles is installed between Stockholm and Gothenburg it will make what is said will be the greatest underground cable system outside of the United States. There will be necessary 425,000,000 conductor feet of cable, 25,000 loading coils and eight repeater stations with 300 repeaters, all of which are being manufactured at Hawthorne, Ill., of American materials. It is expected that a year and a half will be required to put the system into operation.

Southern Electric Occupies New Quarters

Announcement is made of the removal of the Southern Electric Supply Company, Atlanta, Ga., from 31 Peters Street to its new building at 557 Whitehall Street. The new building is a modern fireproof structure in the wholesale district of Atlanta. It is of three stories and designed particularly with a view to the most improved methods of handling and storing electrical materials.

Black & Decker's Increase in 1920 Is 40 per Cent

In spite of general conditions in 1920 the Black & Decker Company, Baltimore, Md., announces that it was the most successful year in the company's history, net sales being nearly 40 per cent greater than the highest previous year, 1919. Dividends of about 7 per cent were paid on the common stock of the company, the last one being on Dec. 31, 1920.

The board of directors has been augmented from five to seven by the election of Charles C. Homer, Jr., and William G. Baker, Jr., both of Baltimore.

The Eclipse Electric Machine Company, 660 Second Street, St. Louis, Mo., has awarded contract for construction of a one-story and basement factory, 56 ft. x 150 ft., on Thirty-first Street, to cost about $17,000.

The General Electric Company, Schenectady, N. Y., has prepared plans for the erection of a four-story addition, 76 ft. x 125 ft., to building No. 76 at its plant in Lynn, Mass., to cost about $175,000.

S. H. Stover & Company, Pittsburgh, has taken over the sale and distribution of the Walger connectors, manufactured by the Walger Connector Company, Toronto, Canada.

The Protective Electrical Supply Company, 130 West Columbia Street, Fort Wayne, Ind., has recently filed notice of increase in capital stock from $200,000 to $300,000.

The General Electric Company, Schenectady, N. Y., has prepared plans for the erection of a four-story addition, 76 ft. x 125 ft., to building 74 at its plant in Lynn, to cost about $175,000.

The Western Electric Company has closed a lease for 100,000 sq.ft. of floor area at the corner of Winchester Street and Pershing Road, Chicago. This space will be utilized for the storage of raw materials and finished products, and the company's branch houses throughout the Middle West will be supplied from this point.

The Hale Electric & Engineering Company, Cleveland, Ohio, announces that the manufacture of the "Halectric" radiator has been taken over by the Hale Electric Company, which expects to start production soon with a plant at Massillon, Ohio. The Hale Electric & Engineering Company, which formerly manufactured this radiator, is making curb boxes, automatic motor-driven air compressors, automatic electric controlled unloaders and accessories.

The Edward N. Riddle Company, Toledo, Ohio, has recently moved into its large factory building at 27 Broadway. The new building provides a working floor space in addition to offices and display rooms. Considerable new equipment has been installed for the manufacture of its various lines, including lighting fixtures, lighting novelties, lamps, etc.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has established offices in the Railway Exchange Building, St. Louis, Mo. This is a branch of the Chicago district office and is in charge of Harold Phillips, formerly of the engineering department of Chicago and later manager of the Chicago district office.

J. Livingston & Company, 70 East Forty-fifth Street, New York City, have filed notice of increase in capital stock from $600,000 to $1,000,000.

The American Insulating Company, Norwalk, Conn., is reported to be receiving bids for the erection of a two-story factory building at its plant in Norwalk.

The Connecticut Blower Company, Inc., Hartford, Conn., is offering for public subscription $150,000 in 8 per cent preferred stock, the proceeds to be used for the erection of a new plant. The buildings occupied by the company have been sold.

The Emerson Electric Company, St. Louis, Mo., announces that arrangements have been completed for stocks of Emerson fans to be maintained by the Triumph Electric Company, 211 South Third Street, Minneapolis, Minn., the Electric Supply Company, 386 Jackson Street, St. Paul, Minn., and the Southern Incandescent Lamp Company, Nashville, Tenn.

The Apex Electric Manufacturing Company, Chicago, has filed notice of increase in capital stock to $100,000.

The Warsaw Elevator Company, South Main Street, Warsaw, N. Y., has filed notice of increase in capital stock from $250,000 to $500,000.

The Dayton Engineering Laboratories, 229 East First Street, Dayton, Ohio, has decided to put off the erection of the superstructure for its new five-story-and-basement addition, 200 ft. x 330 ft., until spring. The cost of the plant is estimated at $1,000,000. The foundation work has been completed.

The Briggs & Stratton Company, 1047 Louis Avenue, Milwaukee, Wis., has filed amendments to its charter authorizing an increase in capital stock from $1,700,000 to $1,950,000.

The Syracuse Washing Machine Corporation, Syracuse, N. Y., has filed notice of increase in capital stock from $6,500,000 to $7,000,000. The company manufactures laundry machinery and has recently erected a new plant.

W. H. Corddry, of the Harrisburg office of Gannett, Seelye & Fleming, Inc., consulting engineers, has been placed in charge of the Memphis office of the firm, which covers engineering design, construction, reports and valuation for municipalities, industrials and public utilities.

The Electric Power Equipment Corporation, which was formerly the Lewis & Roth Corporation, has its office and factory at Thirteenth and Wood Streets, Philadelphia, and its officers are L. R. Lewis, president; J. H. Gledhill, vice-president; N. S. Moore, secretary, and F. W. Dinsmore, treasurer.

The Mutual Electric & Machine Company, Detroit, Mich., announces a change in its address owing to the city of Detroit renumbering all properties. The new number for its general offices and factory is 858 Fort Street, West; factory 1, 851 Porter Street.

The Wellman-Seaver-Morgan Company, Cleveland, Ohio, announces that its Atlanta district office has been transferred to Birmingham, Ala., room 302, American Trust Building. Quin W. Stuart continues as district manager.

The United States Light & Heat Corporation, Niagara Falls, N. Y., has filed notice of increase in capital stock from $7,000,000 to $8,500,000.

The Vim Electric & Motor Company, 58 Cortland Street, New York City, has increased its capital stock from $10,000 to $20,000.

The U. T. Hungerford Brass & Copper Company, New York City, announces that it has established a

monel-metal department in charge of John J. Dillon, who for eight years has made a specialty of this metal and its products.

The Wagner Electric Manufacturing Company, St. Louis, Mo., has removed its Cincinnati office to 20 East Ninth Street, where a service station will also be opened. I. W. Pettingill is in charge.

The Chicago Pneumatic Tool Company has appointed E. F. Eissler assistant to the vice-president, with headquarters at 6 East Forty-fourth Street, New York. W. C. Straub, formerly New Orleans district manager, has been appointed to the Pittsburgh branch to succeed Mr. Eissler, and Ross Wyeth, formerly connected with the Pittsburgh office, is in charge of the New Orleans branch, succeeding Mr. Straub.

Landers, Frary & Clark, New Britain, Conn., have purchased the Greenwood mills property at New Hartford, Conn., at a cost of about $280,000. New machinery is being installed at the works. The plant will be ready to start about Feb. 1.

The Post-Glover Electric Company, Cincinnati, Ohio, is considering increasing its capital stock from $120,000 to $720,000.

The Trumbull-Vanderpool Electric Manufacturing Company, Litchfield, Conn., has filed notice of increase in capital stock from $125,000 to $200,000.

The Washkosh Manufacturing Company, Oshkosh, Wis., manufacturer of domestic washing machines, contemplates extension to its works this spring. It has not yet decided whether to erect a new factory or an addition to the present plant. At present the plant is running two or three nights a week to fill orders.

The Electric Sun Company, Miami, Fla., recently incorporated with a capital stock of $220,000 to manufacture electrically operated display signs, will be affiliated with the company of the same name at Asbury Park, N. J., where headquarters are maintained. The incorporators are Charles D. Winters, Ray R. Morgan and William J. Van Vleck, all of Asbury Park.

The Baraboo Manufacturing Company, Baraboo, Wis., recently incorporated to manufacture electrically operated refrigerating units for domestic and commercial use, has leased the former Ruhland Brewing Company's plant, which will be remodeled and equipped as a machine shop. The company is capitalized at $100,000.

Foreign Trade Notes

FIRST INTERNATIONAL INDUSTRIAL FAIR IN HOLLAND.—From Sept. 6 to 16, 1921, there will be held in Utrecht, Holland, the First International Industrial Fair, the directors of which have appointed the Chamber of Commerce for the Netherlands and the Netherlands East and West Indies, Inc., 44 Beaver Street, New York, as their general representative in the United States. Electrical apparatus and supplies will be exhibited, among other wares.

FURTHER HYDRO-ELECTRIC DEVELOPMENTS ON THE CAUVERY, INDIA.—According to *Indian Engineering*, the Mysore government, India, is considering proposals for erecting power stations at two new sites on the Cauvery River, one at the Shimsha Falls and the other at the Makadatu Falls. The first, the higher of the two, is four miles from Sivasamudram. Preliminary investigations have shown that water can be carried from Sivasamudram to Shimsha by a canal and conduit about 11 miles long. The Makadatu project would be on a smaller scale. A fall of 140 ft. would be available about 4 miles below Arkavati Junction, which could develop about 8,000 hp.

BRITISH CORPORATION CONTEMPLATES BUILDING POWER STATION.—The Salford Corporation, England, according to the London *Engineer*, has decided to apply to Parliament for permission to erect a new electric power station on the banks of the Irwell River at Agecroft to supply electricity for the borough. The proposed plans provide for an initial installation of three 15,000-kw. turbo-generating units. Provision will be made in the power station for installation of additional machinery to increase the output by 60,000 kw. It is proposed to transmit at 33,000 volts. The cost of the project is estimated at £1,250,000.

LANARK CORPORATION CONSIDERING AN ELECTRIC PROJECT.—The Council of Lanark, according to the London *Electrician*, has submitted to the Electricity Commissioners four schemes for an electric supply for the Lanark Corporation as follows: (A) Bulk supply from the Clyde Valley Electric Power Company, to cost £58,000; (B) water power from the river Clyde, £45,000; (C) steam turbines, £48,000; (D) gas or oil engines, £30,000.

DEVELOPMENT OF WATER POWER IN CEYLON, INDIA.—Plans are being considered for utilizing the water-power resources in Ceylon to generate electricity. The conversion of some of the railways for electrical operation is also under consideration. Investigations, it is reported, are being made under the supervision of J. W. Meares, electrical adviser to the Indian government.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An inquirer in India (No. 34,280) desires to receive information and quotations on ceiling and desk fans, rated from 220 volts to 240 volts, direct current, and on rubber-covered wire made in accordance with British standards.

A mercantile firm in Bulgaria (No. 34,282) desires to secure an agency for the sale of electrical materials, etc.

A merchant in Canada (No. 34,283) desires to purchase an electric lighting plant for country house, automatic without storage battery, of not less than 1,500 watts.

A mercantile firm in Australia (No. 34,288) desires to secure exclusive agencies from manufacturers for the sale of labor-saving machine tools and electrical fittings of all kinds, etc.

An electrical company in India (No. 34,289) desires to receive quotations from manufacturers of electric ceiling fans of 32, 48 and 56-in. size, with four wooden blades, to operate on 230 volts or 250 volts, direct current, portable fans of 8, 12 and 16-in. sizes, and standard types of metallic-filament lamps, both vacuum and gas-filled types. Sample fans are desired.

A mercantile company in Norway (No. 34,299) desires to secure an agency for the sale of electric specialties, etc.

A manufacturing company in Scotland (No. 34,300) desires to secure an agency for the sale of materials and appliances used by contractors in electrical trades, etc.

THE CHAMBER OF COMMERCE for the Netherlands and the Netherlands East and West Indies, Inc., 44 Beaver Street, New York City, invites communication with manufacturers who desire to make connections in Holland or India for the sale of electrical products. The chamber has branch offices in Amsterdam, Holland, and Batavia, Java.

New Apparatus and Publications

RUBBING AND TRIMMING MACHINES.—The Mattison Machine Works, Rockford, Ill., is distributing two four-page pamphlets, one describing its electric rubbing machine for varnished surfaces and the other covering its electric edge veneer trimmer, both for 110 volts or 220 volts.

INTEGRATING SPHERES AND PHOTOMETERS.—Foote, Pierson & Company, Inc., 160 Duane Street, New York City, has published catalog No. 32, covering its integrating spheres and photometers and accessories.

HEATERS, CONDENSERS AND PUMPS.—The Ross Heater & Manufacturing Company, 1407-11 West Avenue, Buffalo, N. Y., is distributing catalog "F," in which it describes and illustrates its various types of heaters, condensers, expansion joints, coolers and airjector pumps.

OIL CIRCUIT BREAKERS.—The General Electric Company, Shenectady, N. Y., has issued bulletin No. 47419A, superseding bulletin No. 47419, in which it describes its type FP-10 small-capacity industrial oil circuit breaker, 50 amp., 600 volts, for three-phase and quarter-phase induction motors of 25 hp. or less.

AUTOMOBILE ENGINE HEATER.—The National Electrical Supply Company, 1330 New York Avenue N. W., Washington, D. C., is distributing a sheet describing and illustrating the Calorel automobile engine heater for garage use, operating on 110 volts.

FLOODLIGHT PROJECTORS.—In bulletin No. 304-A, just circulated by the Crouse-Hinds Company, Syracuse, N. Y., there is described the Imperial floodlight projectors and reflectors developed since the publication of bulletin No. 304, which is still effective.

WIRE AND CABLE.—General Electric Company's bulletin No. 49,305 covers its "Wires and Cables."

New Incorporations

THE BENNETT FLUE BLOWER COMPANY, New York City, has been incorporated by A. J. Ward, L. F. Hulton and G. H. Jett, 206 West Sixty-ninth Street. The company is capitalized at $250,000 and proposes to manufacture flue-cleaning equipment and other power-plant specialties.

THE EFFICIENT ELECTRIC PROTECTION COMPANY, 30 Kent Street, Newark, N. J., has been organized to manufacture electric alarm systems and equipment. Frank Silsen, 86 Jefferson Street, is interested in the company.

THE CONNECTICUT DYNAMO & MOTOR COMPANY, Irvington, N. J., has been incorporated with a capital stock of $150,000 to manufacture electrical machinery. The incorporators are Harry J. Brewer, Gerald Hannay, Lyons Avenue and Woolsey Street, Irvington, and Donald B. Munsick, 786 Broad Street.

THE MAPLES WASHING MACHINF COMPANY, New York City, has been incorporated by R. Lasker, D. H. Lehman and L. Maples, 311 Fifth Avenue. The company is capitalized at $1,000,000 and proposes to manufacture electrically operated washing machines and parts.

THE ELECTRIC AUTO SIGNAL COMPANY, Wilkinsburg, Pa., has been incorporated by B. Hudson, Wilkinsburg; A. J. Henseler, Pittsburgh, and C. R. Blakely, Trafford, Pa. The company is capitalized at $100,000 and proposes to manufacture electrically operated automobile products.

THE LIBERTY MACHINE COMPANY, Wauwatosa, Wis., has been incorporated by William J. Grede, A. E. Stroud and Jeremiah Keeler. The company is capitalized at $10,000 and proposes to manufacture metal products, principally electric and gas-lighting fixtures.

THE PRICE MACHINE & ELECTRIC WORKS, 115 West Pico Street, Los Angeles, Cal., has been organized to manufacture machine parts and electrical apparatus. Morris Price, 4323 South Olive Street, is interested in the company.

THE PARAMOUNT ELECTRIC FIXTURE COMPANY, 6278 Hollywood Boulevard, Los Angeles, Cal., has been organized to manufacture metal electric lighting fixtures. J. J. Strauss, 5737 Virginia Avenue, is interested in the company.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 28, 1920)

1,363,806. REGULATOR FOR DYNAMO-ELECTRIC MACHINES; William B. Moses, Brookline, Mass. App. filed Oct. 18, 1915. Eliminates trouble from vibration.

1,363,807. ELECTRICAL BODY-CONTACT DEVICE; James W. Murphy, Chicago, Ill. App. filed April 28, 1920. Medical.

1,363,813. ATTACHMENT FOR ELECTRICAL CONTROLLERS; Estell C. Raney, Columbus, Ohio. App. filed April 21, 1919. Drum controller.

1,363,814. AUTOMATICALLY RECLOSING CIRCUIT BREAKER; Estell C. Raney, Columbus, Ohio. App. filed June 13, 1919. Sectionalizing breaker.

1,363,815. ELECTRODE HOLDER; Byramji D. Saklatwalla and Arthur N. Anderson, Crafton, Pa. App. filed April 24, 1919. For furnaces.

1,363,827. APPARATUS FOR THE TREATMENT OF GASES BY ELECTRIC DISCHARGE; Ernest E. Werner, St. Louis, Mo. App. filed March 4, 1920. Inclosed electrodes.

1,363,841. ELECTRIC CLOCK; Norman Collins, London, England. App. filed July 25, 1919. Oscillations maintained by electromagnet.

1,363,877. ELECTRIC RIVET HEATER; Arthur Imbery, Halifax, York, England. App. filed May 10, 1920. For cleaning rivets before or during the heat.

1,363,889. BATTERY-TEMPERATURE CONTROLLER; Charles E. Linebarger, Chicago, Ill. App. filed March 17, 1919. Thermostatic.

1,363,919. LIGHTING FIXTURE; Grosvenor P. Robinson, Summit, N. J. App. filed April 3, 1920. Modified indirect.

1,363,924. BATTERY-LIGHT ATTACHMENT; Arthur D. Saborsky, Lakewood, Ohio. App. filed Dec. 30, 1914. Miniature electric bulb upon any dry cell.

1,363,942. ELECTRICAL CONNECTING AND SUPPORTING DEVICE; Ernest C. White, New York, N. Y. App. filed Jan. 10, 1920. For hanging a fixture.

1,363,947. ELECTRIC HEATER; Henry J. Youngblood, Los Angeles, Cal. App. filed Oct. 9, 1919. Attached to ordinary spigot.

1,363,948. ELECTRIC HEATER; Henry J. Youngblood, Buffalo, N. Y. App. filed Feb. 28, 1920. Electrically heated liquid-discharging faucet.

1,363,965. SURGICAL AND MEDICAL INSTRUMENT; Ernesto Fuchs, Guadalajara, Mexico. App. filed Jan. 26, 1920. For electrically treating cavities of human body.

1,363,991. ELECTROMECHANICAL JACK; Edward L. Monnot, Canton, Ohio. App. filed Jan. 15, 1920. For dental, surgical and barber chairs.

1,363,995. TROLLEY; Joseph Privarnik, McAdoo, Pa. App. filed Aug. 21, 1920. Will not jump.

1,364,011. INSULATED AND PROTECTED GRID; Malcom O. Smith, Indianapolis, Ind. App. filed April 16, 1920. Battery.

1,364,013. TELEPHONE TRANSMISSION SYSTEM; Ray S. Silbur, Lyndhurst, N. J. App. filed Dec. 11, 1917. Two-way, two-repeater circuits.

1,364,026. TROLLEY-WIRE CLAMP; Glenn H. Bolus, Mansfield, Ohio. App. filed Sept. 7, 1917. Readily inserted.

1,364,027. TROLLEY-WIRE CLAMP; Glenn H. Bolus, Mansfield, Ohio. App. filed July 27, 1918. For severe conditions.

1,364,028. INSULATED TROLLEY HANGER; Glenn H. Bolus, Mansfield, Ohio. App. filed June 19, 1919. Installed easily. For automobiles.

1,364,048. LOCK; Homer E. Gilland, Grand Rapids, Mich. App. filed June 7, 1919.

1,364,051. PROCESS OF ELECTROPLATING; James S. Gross, Newport, R. I. App. filed Aug. 18, 1920. For preventing erosion or oxidation.

(Issued Jan. 4, 1921)

1,364,078. TELEGRAPHIC ALPHABET OR CODE; Albert C. Crehore, Yonkers, N. Y. App. filed Dec. 13, 1918. Abbreviated.

1,364,080. BALLASTING DEVICE; Clinton J. Davisson, Maplewood, N. J. App. filed Dec. 23, 1919. To steady fluctuating current.

1,364,086. TELEGRAPH SYSTEM; Andrew D. Dowd, Hoboken, N. J. App. filed Jan. 4, 1918. Printing.

1,364,106. AUTOMATIC TELEPHONE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed March 28, 1918.

1,364,129. SYSTEM OF ELECTRICAL TRANSMISSION AND DISTRIBUTION; Frederich W. Meyer, Milwaukee, Wis. App. filed March 29, 1918. High-tension direct current.

1,364,148. CUPPING DEVICE; Thomas H. Springer, Waterloo, Ia. App. filed March 15, 1920. Medical.

1,364,158. METHOD OF AND APPARATUS FOR TESTING REPEATER CIRCUITS; John F. Toomey, New York, N. Y. App. filed Jan. 31, 1917. Testing transmission efficiency and ringing apparatus.

1,364,159. THROUGH-RINGING REPEATER CIRCUITS; John F. Toomey, New York, N. Y. App. filed Jan. 31, 1917. Two-way two-repeater circuits.

1,364,162. TELEPHONE-EXCHANGE SYSTEM; Horace W. Ulrich, East Orange, N. J. App. filed Jan. 4, 1918. Automatic ringing.

1,364,167. CURRENT CONTROLLER FOR INDUCTION COILS; Paul R. Werner, Philadelphia, Pa. App. filed Feb. 24, 1915. For producing sparks.

1,364,170. INDICATOR FOR TELEPHONE-EXCHANGE SYSTEMS; Edgar W. Adams, East Orange, N. J. App. filed Oct. 23, 1918. To indicate number of calling line.

1,364,208. TROLLEY; William Rennie, Shadyside, Ohio. App. filed April 22, 1919. Prevented from leaving wire.

1,364,212. HEATER FOR ELECTRIC AUTOMOBILES; Jay I. Sharpe, Zanesville, Ohio. App. filed Dec. 15, 1919.

1,364,227. RECORDER; James M. Wight, Lakewood, Ohio. App. filed Dec. 15, 1916. Graphic meter.

1,364,258. TROLLEY-WHEEL GUARD; George Dzurko, Pleasant City, Ohio. App. filed Oct. 25, 1920. For retaining trolley wheel in engagement.

1,364,299. STORAGE BATTERY; Irvine M. Noble and Walter E. Gossling, Indianapolis, Ind. App. filed July 23, 1919. For isolated plants.

1,364,335. ELECTRICAL CONNECTING AND SUPPORTING DEVICE; Ernest C. White, New York, N. Y. App. filed Jan. 10, 1920. Connects and supports fixture simultaneously.

1,364,358. BATTERY TRAY; Thomas A. Edison, Llewellyn Park, N. J. App. filed Dec. 13, 1915. For supporting and securely holding group of cells.

1,364,359. PROTECTING VARNISH FOR ELECTRODES OF ELECTROLYTIC CELLS; Thomas A. Edison, Llewellyn Park, N. J. App. filed Sept. 29, 1919. For electroplating.

1,364,364. METER-TESTING SWITCH; Benjamin E. Getchell, Plainville, Conn. App. filed Nov. 17, 1919. Tested without interrupting local circuit.

1,364,377. ELECTRIC METER; Charles F. Jenkins, Washington, D. C. App. filed June 22, 1918. Hot-wire.

1,364,382. ELECTRIC SWITCH FOR STOVE LIGHTERS AND THE LIKE; Milo W. Kibbe, Los Angeles, Cal. App. filed June 2, 1920. Plurality of actuating buttons.

1,364,390. STORAGE-BATTERY ASSEMBLY; Lamar Lyndon, West Orange, N. J. App. filed April 30, 1919. For cells of great size and weight.

1,364,393. BATTERY HAND LAMP; Thomas J. Madigan, Brooklyn, N. Y. App. filed April 6, 1920. Flashlight.

1,364,419. ELECTRICAL CONNECTING AND SUPPORTING DEVICE; Ernest C. White, New York, N. Y. App. filed April 9, 1920. Fixture hanger and connector combined.

1,364,469. STORAGE-BATTERY CONTAINER; Joseph L. Woodbridge, Philadelphia, Pa. App. filed Feb. 13, 1919. Cover satisfactorily sealed.

1,364,488. STEAM-PROPELLED VEHICLE; John A. Doble, San Francisco, Cal. App. filed May 15, 1917. Means for condensation of exhaust steam.

1,364,493. METHOD OF MAKING STORAGE-BATTERY SEPARATORS; Bruce Ford and Edward W. Smith, Philadelphia, Pa. App. filed Feb. 28, 1918. Slit sheet.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—In connection with the reorganization of the Boston Suburban Electric Company, the stockholders have arranged for the disposition of a security issue, the proceeds to be used for operations, extensions, etc.

THREE RIVERS, MASS.—The Palmer Mills are having plans prepared for a 30-ft. x 70-ft. transformer station at their plant. Lockwood, Greene & Company, 60 Federal Street, Boston, are architects and engineers.

Middle Atlantic States

CAMPBELL, N. Y.—The Aulls Electric Corporation, with a capital stock of $10,000, has been granted a charter to generate electricity for light, heat and power purposes in Campbell and Savona. The village of Savona voted to issue bonds for the installation of the electric system with the main plant at Campbell.

ENDICOTT, N. Y.—Arrangements are being made for the installation of electrically operated pumping equipment at the municipal waterworks to replace the existing steam-driven apparatus. Energy will be served by the Binghamton Light, Heat & Power Company, Binghamton.

OGDENSBURG, N. Y.—The New York & Ontario Power Company has applied to the Federal Power Commission, Washington, D. C., for permission to erect a dam across the south channel of the St. Lawrence River for the development of approximately 25,000 hp.

ORANGEBURG, N. Y. — The Rockland Light & Power Company has filed notice of increase in capital from $1,300,000 to $1,600,000 for proposed expansion.

WEST BURLINGTON, N. Y.—D. T. Gardner of this place has applied to the Public Service Commission, Second District, for permission to construct and operate an electric lighting plant under franchises granted by the towns of Burlington and Edmeston supplying West Burlington and Edmeston lighting district.

BLOOMFIELD, N. J.—The Clark Thread Company, Clark and Ogden Streets, Newark, has had plans prepared for the erection of a power plant to cost about $63,000, to be used in connection with its proposed bleaching works, to cost $133,000. A. H. Groel is general manager.

LYNDHURST, N. J.—The Board of Education will receive bids until Feb. 1 for electrical equipment to be installed in the proposed new school at Stuyvesant and Kingsland Avenues. A. L. Vegliante, Garfield, is architect.

TRENTON, N. J.—The Trenton & Mercer County Traction Corporation, 137 East State Street, plans to make repairs and improvements to its electric power station. C. Häckel is chief engineer.

HARRISBURG, PA.—An ordinance has been passed by the City Council authorizing the employment of Dr. W. L. Robb, head of the electrical department of the Rensselaer Polytechnic Institute, Troy, N. Y., to make an investigation for the city, of the plant and system of the Harrisburg Light & Power Company, with a view to making recommendations for adequate service. The work will be conducted under direction of Commissioner Hassler.

NEW HOPE, PA.—The Clay Products Corporation of America, Liberty Building, Philadelphia, contemplates the erection of an electric power plant in connection with its new brick manufacturing plant at this place. A railway system will also be constructed from the plant to the clay properties. The total cost is estimated at $900,000.

PITTSBURGH, PA.—Application has been made by the West Penn Power Company to the Public Service Commission for permission to issue stock for $2,500,000, the proceeds to be used for operations, extensions and improvements.

STEELTON, PA.—The finance committee of the City Council and the water department are planning for the installation of one 30-hp. and one 150-hp. electric motor to be used in place of boilers. Centrifugal pumps will also be installed. G. H. Roberts is president of the water department. The cost is estimated at $50,000.

WHEELING, W. VA.—The Sisters of the Good Shepherd, Edginton Lane, contemplate alterations to the power plant. S. F. Heckert, Bessemer Building, Pittsburgh, Pa., is engineer.

North Central States

DETROIT, MICH.—The Park-Davis Company, Atwater Street and McDougal Avenue, contemplates the erection of an electrically operated factory for the manufacture of drugs. The first unit of construction is estimated to cost about $4,000,000. Smith, Hinchman & Grylls, 710 Washington Arcade, are engineers and architects.

CLEVELAND, OHIO.—The city officials will receive bids until Jan. 27 for electric and power wiring to cost about $60,000 for a convention hall now under construction. J. W. Bean, 5716 Euclid Avenue, is engineer.

COLUMBUS, OHIO.—The Board of Trustees of the Ohio State University has asked for appropriation of $4,000,000 to carry out a construction program. Plans include a new unit for the power plant to cost $384,000.

COLUMBUS, OHIO.—It is planned to install cluster lights on West Broad Street, Cleveland Avenue, Mount Vernon Avenue, Main Street and Long Street. The total estimated cost is $240,919.

MILFORD, OHIO.—The village officials will receive bids in about two months for motor-driven centrifugal pumps or steam-driven pumps to be used in connection with the waterworks plant. S. T. Bateman is clerk.

ST. CLAIRSVILLE, OHIO.—The city officials plan to make improvements to the municipal electric light plant.

LOUISVILLE, KY.—A wireless plant will be erected at the College of Arts and Science Building at the Louisville University.

CHAMPAIGN, ILL.—Plans are under way for the installation of a lighting system on various streets, to cost about $25,000. F. C. Lohman, City Hall, is engineer.

CHICAGO, ILL.—Felt & Tarrant, 1717 North Paulina Street, have plans under way for the construction of a factory for the manufacture of adding machines and a 60-ft. x 100-ft. power plant, to cost about $1,000,000. Power-plant equipment will be required. L. G. Hallberg & Company, 166 South Michigan Boulevard, is architect.

EDGERTON, WIS.—G. T. Simmons, R. F. D. No. 8, Janesville, contemplates the erection of a factory for the manufacture of spark plugs, estimated to cost about $100,000. The construction of a separate power plant is being considered.

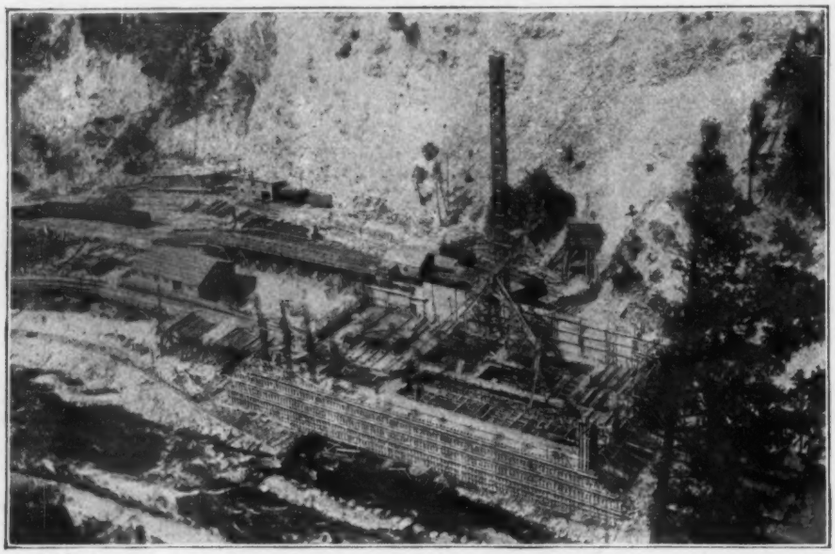
MILWAUKEE, WIS.—The Sewage Commission will readvertise soon for new bids for equipment and boiler for the Jones Island power plant. Former bids rejected. T. C. Hatton, City Hall, is engineer.

HASTINGS, MINN.—The State Board of Control, Capitol, St. Paul, will submit to the Legislature a construction program, including the erection of a power plant and the installation of equipment at the State Asylum for the Insane at this place. The cost is estimated at about $70,000.

ROLLA, MO.—Bonds to the amount of $25,000 have been voted for the installation of equipment in the power plant, giving the plant a double unit for light and water service.

ST. LOUIS, MO.—The United Railways Company, Thirty-ninth and Park Avenues, contemplates the erection of four new substations of 1,000 kw. each and changing two existing substations, to be of 2,000 kw. each, from alternating current to direct current. Rotary converters and control equipment for the six substations will be required. The cost is estimated at $285,000. W. E. Bryan, above address, is engineer.

GRAFTON, N. D.—The State Home for the Feeble-Minded plans to erect several buildings, including a workhouse, mill-house and power house. The cost is estimated at about $583,500. A. R. T. Wylie is superintendent.



GREAT WESTERN POWER COMPANY, CALIFORNIA, NEW 40,000-KW. HYDRO-ELECTRIC PLANT UNDER CONSTRUCTION 186 MILES NORTHEAST OF SAN FRANCISCO IN THE HIGH SIERRAS

ELK POINT, S. D.—The city officials contemplate holding a special election for the purpose of submitting a proposition to make light and power improvements at a cost of about $20,000. M. R. Hendricks is city recorder.

PARSONS, KAN.—The city officials have plans under way for rehabilitation of the waterworks system, including the rebuilding of power plants, installation of filter equipment and machinery for 6,000,000 gal. capacity, etc. The cost is estimated at about $350,000. Burns & McDonnell, Interstate Building, Kansas City, Mo., are designing and consulting engineers.

TOPEKA, KAN.—The city officials contemplate the erection of an electric power plant building, 32 ft. x 76 ft., to adjoin the waterworks plant. W. A. Stanfield is commissioner of the water department.

Southern States

MOUNT HOLLY, N. C.—Surveys have been made by the Blue Ridge Development Company, Hickory, for an electric railway from Mount Holly to Blowing Rock, to cost about $100,000.

POMPANO, FLA.—The Pompano-by-the-Sea Company, 39 N. E. Second Avenue, Miami, plans to install an electric and water plant at this plant. A. T. Barkdull is secretary.

SAFETY HARBOR, FLA.—The Town Commissioners have ordered an election to be held for the purpose of submitting a proposition to issue $10,000 in bonds for the purchase and establishment of an electric light plant.

CHATTANOOGA, TENN.—The Du Bois Rubber & Tire Company, 315 Volunteer State Building, is having plans prepared for a power plant, 42 ft. x 50 ft., in connection with its proposed automobile tire manufacturing plant. The cost is estimated at $75,000. W. L. McLane, above address, is architect.

BELLWOOD, ALA.—An issue of $750,000 has been proposed by the city officials for the erection of a power plant on the Choctawhatchie River.

BIRMINGHAM, ALA.—The Birmingham Waterworks Company is receiving bids for two 10,000,000-gal. turbine centrifugal improvements, including the installation of pumps at the Cahaba River pumping station. Other equipment and fitting will be installed. The total cost is estimated at about $400,000. H. Horner is superintendent of the waterworks.

TUSCALOOSA, ALA.—The building committee of the Alabama Home for the Feeble-Minded will receive bids until Feb. 15 for the construction of a power house, main dormitory and laundry at the institution, to cost about $175,000. D. O. Whilldin, Title Guaranty Building, Birmingham, is architect.

COLEMAN, TEX.—The city officials contemplate remodeling and improving the electric light plant.

Pacific and Mountain States

TACOMA, WASH.—The city officials contemplate making extensive improvements and additions to the municipal light and power system during the year, independent of the development of the Lake Cushman project. A substation will be erected in the north end of the city, designed to transform 8,000 kw. or 10,000 kw. high-tension lines for residential use, to cost between $70,000 and $100,000. A second substation will be erected for South Tacoma at the pumping station of the water department, where transformers are already installed for the use of that department. L. Evans is superintendent of the light plant.

ASHLAND, ORE.—Mayor Lamkin at a recent meeting of the Chamber of Commerce suggested that the proposition to erect a municipal power plant be submitted to the voters.

MODESTO, CAL.—The city officials will open bids about April 1 for the construction of the Don Pedro Dam for the development of power at this place. The cost of the project is estimated at about $3,075,000. A. J. Wiley is engineer.

PAYSON, UTAH.—Plans have been approved by the City Council for the erection of seventy-two iron posts for an ornamental street-lighting system to be installed in the spring at a cost of about $7,000. C. A. Swan, Provo, is engineer.

SALT LAKE CITY, UTAH.—L. E. Cluff, Felt Building, has filed application with the state engineer for the diversion of water from Fish Creek, Piute County, for the development of 1,200 hp. to supply energy for seven counties.

Canada

VICTORIA, B. C.—The Minister of Public Works will receive bids until Feb. 1 for two 20,000 Imperial g. p. m. centrifugal pumps, for the Maple Ridge diking district. J. A. Wilson is engineer.

ST. JOHN, N. B.—The Madawaska Light & Power Company has plans under way for the construction of a power plant for the development of from 20,000 hp. to 25,000 hp.

KITCHENER, ONT.—A by-law providing $37,800 was voted on for the erection of a power house and the installation of an elevator at the Kitchener-Waterloo Hospital.

MONTREAL, WEST, QUE.—At a recent election it was voted to expend $117,000 to provide for a new lighting system with underground conduits.

Miscellaneous

TAMPICO, MEXICO.—The Standard Oil Company of New Jersey, 26 Broadway, New York City, contemplates the erection of a pumping station in the oil fields at this place, to include twelve large pumping units, a battery of twenty-eight boilers and auxiliary operating equipment. The company will also erect two central power plants for oil-field service.